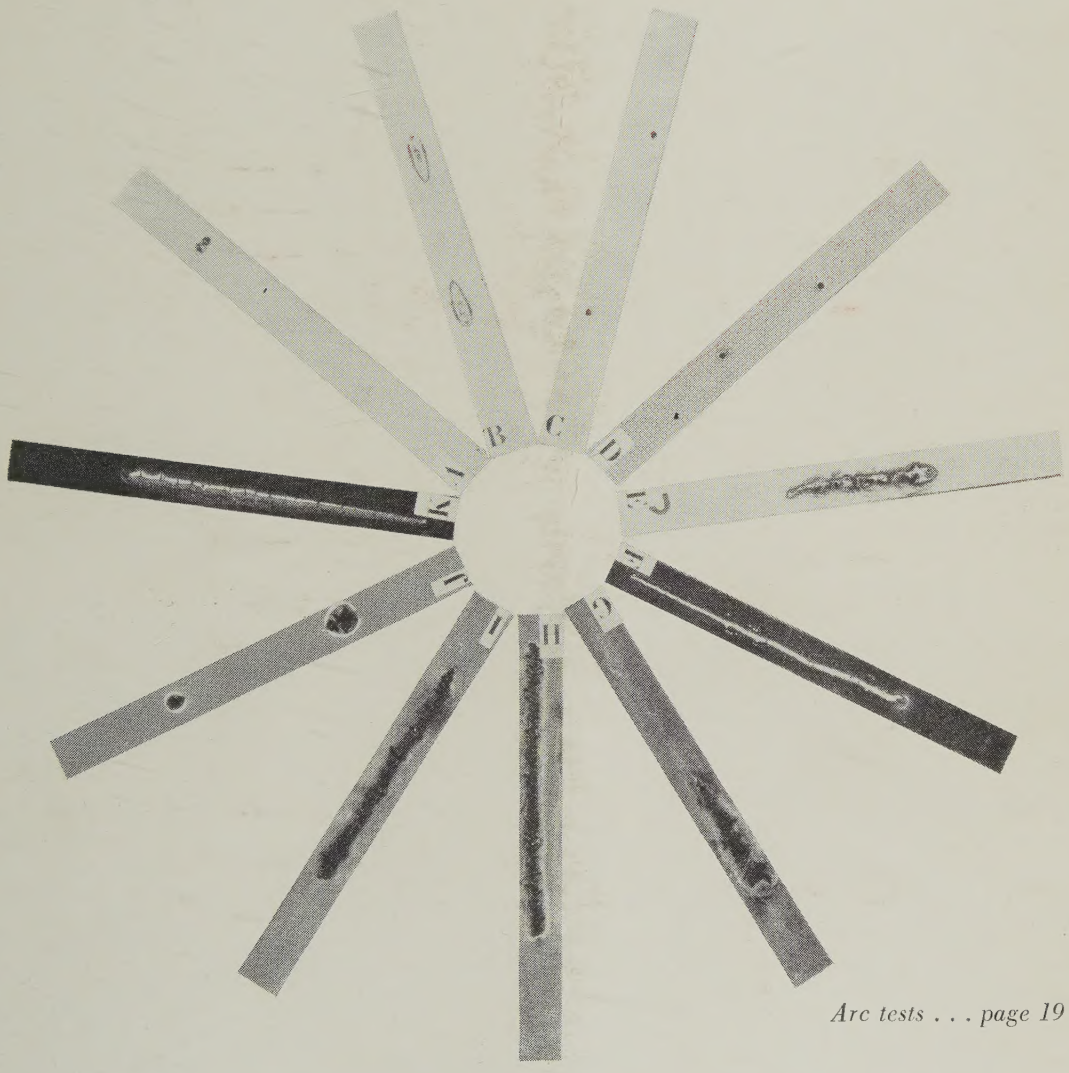
May 1960

Insulation



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Solidifying fluid problems . . . page 25
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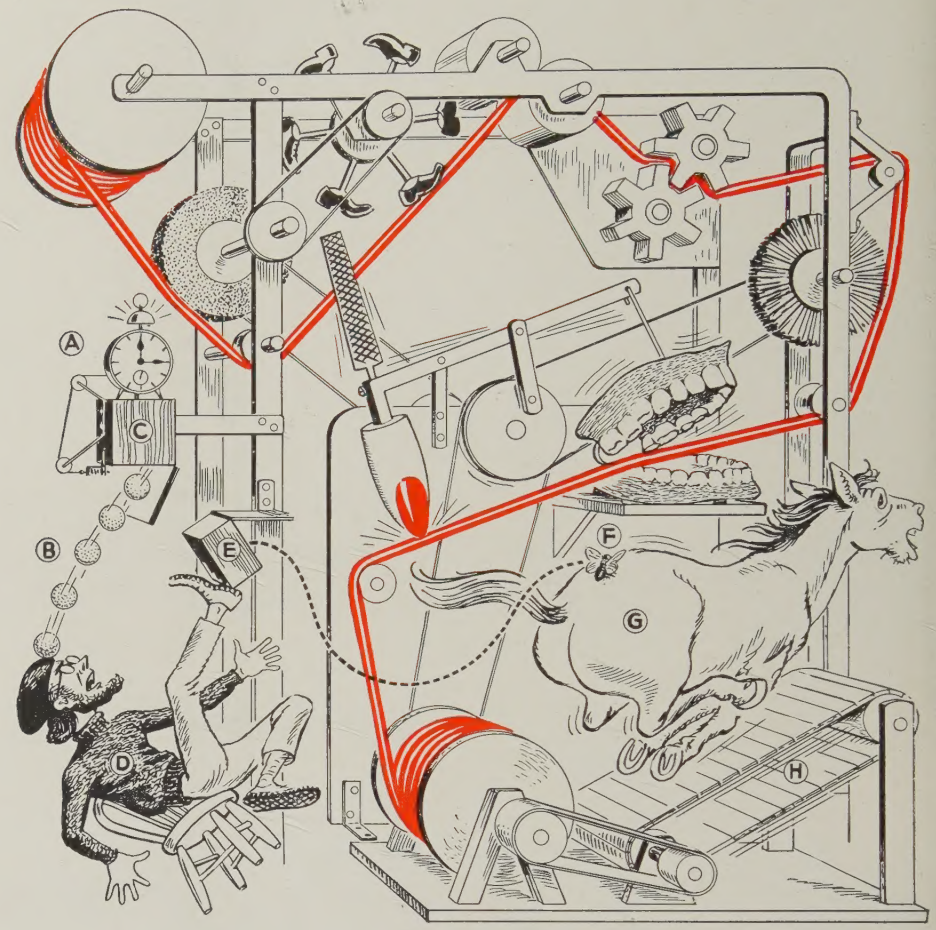
NOW.. the first effective abrasion test for insulation sleevings



OPERATION OF THE ABRASOGRAFT

Alarm "A" rings, releasing golf balls "B" in Trap "C". Technician "D" is rudely awakened, kicks box "E" which frees horsefly "F". Fly bites horse "G" which stampedes on treadmill "H". Treadmill activates the Abrasograft and puts Ben-Har "1151" through its paces.

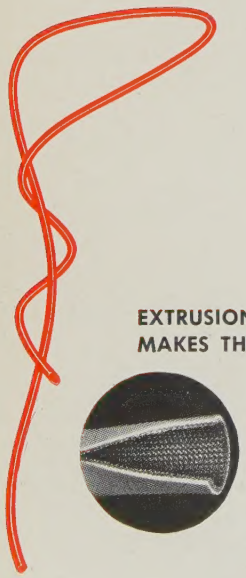
Aware of the void in standard testing procedures for abrasion resistance in insulating sleevings, Bentley-Harris commissioned Ubiquitious Associates, Limited, to correct the situation. Their chief designer, Dr. Kool(man), secreted in his study and stimulated by an exclusive diet of cheap whiskey, vitamin tablets and tranquilizers, produced the Abrasograft (illustrated above).

[Dr. Kool(man) is best remembered for his suggestions: to increase the number of commercials as the late, late show progresses; to double the sound volume of radio commercials; and to leave the fibrous parts in deviled crabs.]

The single phase, double reciprocating, triple purge, quadruped Abrasograft ran 1151 feet of the new Ben Har "1151" in size 36 (especially produced for the doctor as he is a stickler for perfection).

After 1151 hours, there was no blemish on the satin-smooth skin of the sleeving. Then, the Abrasograft exploded, plowing a trench 1151 feet long. When last seen, Dr. Kool(man) was at the far end furiously munching on the 1151 feet of undamaged Ben Har "1151" and muttering, "It's gotta give . . . it's gotta give."

Tough, expandable, resistable and completely able Ben Har "1151" **durasyl** Silicone Rubber—Fiberglass Sleeving comes in all the usual sizes, in white and living color. Don't take our word for its electrical insulation powers. Send for data sheet and samples and try your own patience.



EXTRUSION MAKES THE DIFFERENCE

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500 BARCLAY STREET **CONSHOHOCKEN 6, PA.**
Telephone: TAylor 8-7600
A SUBSIDIARY OF RAYCHEM

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HOW TO FLATTEN OUT YOUR INSULATION MATERIAL COST CURVE

In spite of other constantly rising prices, there are ways to level out your electrical insulation material costs . . . even to reduce them in some instances. One way is to substitute more economical materials—with no sacrifice of important property standards. Another way is to eliminate high labor cost production and assembly methods through the use of different materials.

But only a specialist knows all the materials which can meet the requirements of your application . . . new products that are available . . . and how changes in materials have permitted other companies to achieve cost-cutting production economies. Dozens of factors enter the cost picture—for example, one material may be better and more expensive yet save you money because less material is needed. All these factors are known to Prehler men. This is natural because Prehler sells nearly every conceivable type of insulation to provide the widest possible selection. What's more, Prehler has direct contact with the laboratories of the leading insulation producers—Prehler is familiar with new materials which are planned and which may help you to cut your costs and improve your products. And, Prehler men have been contacting companies such as yours for years—this experience has given them a storehouse of hundreds of ideas for cutting production costs.

Take advantage of Prehler's unique ability to flatten out your cost curve—call your nearest office, today.

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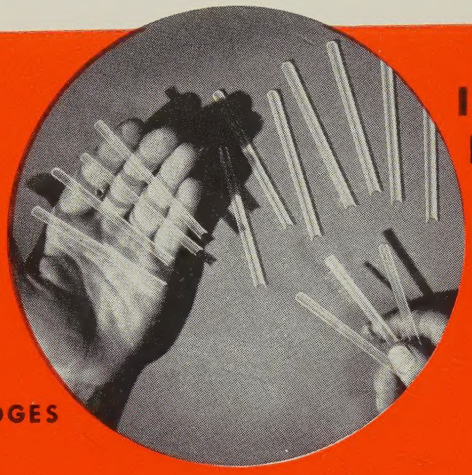
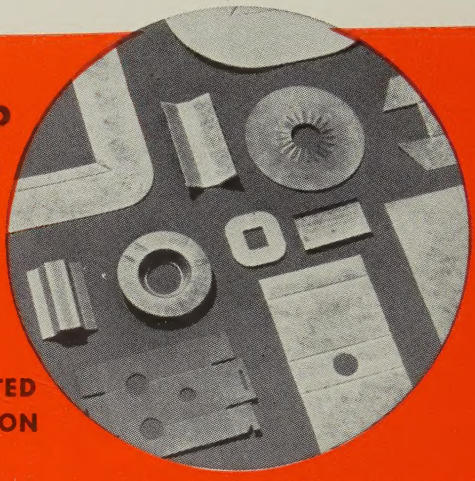


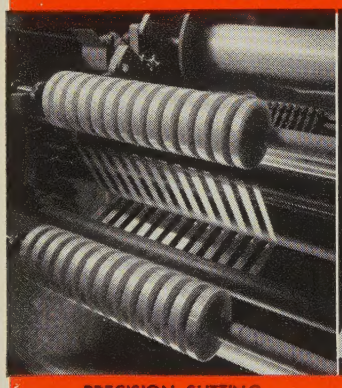
WEDGES

Ask for Inmanco Products List No. 32

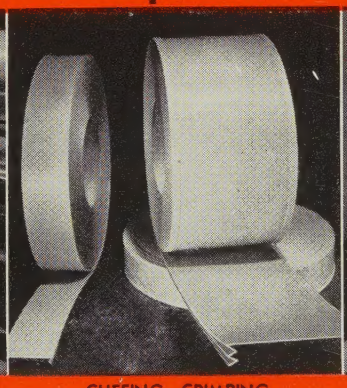


FABRICATED INSULATION

Inmanco Operations

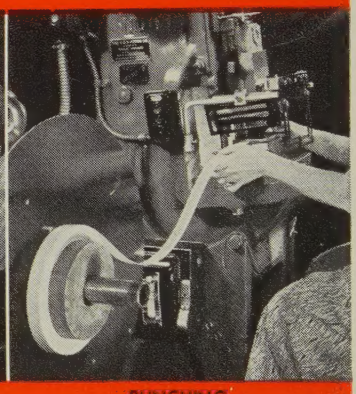


PRECISION SLITTING



CUFFING, CRIMPING

SHEARING



PUNCHING

Inmanco is the product name used to describe the electrical insulation materials made or fabricated by the INMANCO Division of Insulation Manufacturers Corporation. INMANCO stands for quality insulations made ready for customer use in their most convenient and economical form, size, and shape.

Inmanco has two factories which work to serve you, our customers. At Escanaba, Michigan, are made hard maple wood wedges, tapered wedges, and round dowels, and other products which can be made on woodworking machinery. At Chicago, Illinois, are fabricated thousands of other INMANCO electrical insulation parts from well-known nationally recognized brands of the highest quality electrical insulating materials.

Inmanco products today are prominent in the IMC sales program. They are sufficiently important to be manufactured and fabricated by a separate division which is called the INMANCO Division of Insulation Manufacturers Corporation. The growth and expansion of these operations has made the separation from the IMC distribution activity a desirable and practical step. This is because INMANCO operations now go well beyond their original function of providing IMC customers, in whatever form these users desired or preferred, the various electrical insulating materials which IMC handled as a distributor. Therefore, Products List No. 32 covers only INMANCO products which are manufactured or fabricated in the two INMANCO plants.

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INSULATION MANUFACTURERS CORPORATION

565 West Washington Boulevard, Chicago 6, Illinois

Branch Offices, Representatives, and Distributors in Principal Cities

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Insulation

For the Electrical and Electronic Industries

Lake Publishing Corporation, 311 East Park Ave., Libertyville, Illinois, May 1960

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J. Chottiner

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NBP Member National Business Publications, Inc.

Advertising Sales Offices: See page 86.

From the Editor

Opinions and Rambling Thoughts

What Next?

DuPont sent out an intriguing little item some months ago. It seems that plastic stays that are rigid enough to replace steel stiffeners in many types of garments are now being produced of "Mylar" polyester film. DuPont reports that the new technique is particularly adaptable to women's undergarments and bathing suits and in this connection, mention is made of the material "being used as a shaping and styling device." We have always thought that the many electrical insulation applications for Mylar polyester film were legitimate and valid, and because of this we have had a high opinion of DuPont. Thus, it is with a great deal of sadness and regret that we find that DuPont has joined those sinister and subversive elements that would deceive the American male. In view of this new use for Mylar polyester film, it is with increasing trepidation and trembling hands that we shall read future announcements of new applications for such products as "Teflon" resins and "Zytel" materials.

Meetings this Month

Two meetings of importance to men interested in insulation are being held this month. The Electrochemical Society is holding its technical meeting at the LaSalle Hotel in Chicago May 1 to 5. A number of sessions on electrolytic capacitors as well as a general session are scheduled by the Electric Insulation Division of the Society.

In Miami Beach at the Hotel Fontainebleau, the National Industrial Service Association Inc. is holding its 27th Annual Convention May 8 to 11. As usual, a portion of the program schedule will be devoted to insulation topics. NISA is the trade organization of electrical apparatus service shops.

Ten Commandments of Discussion

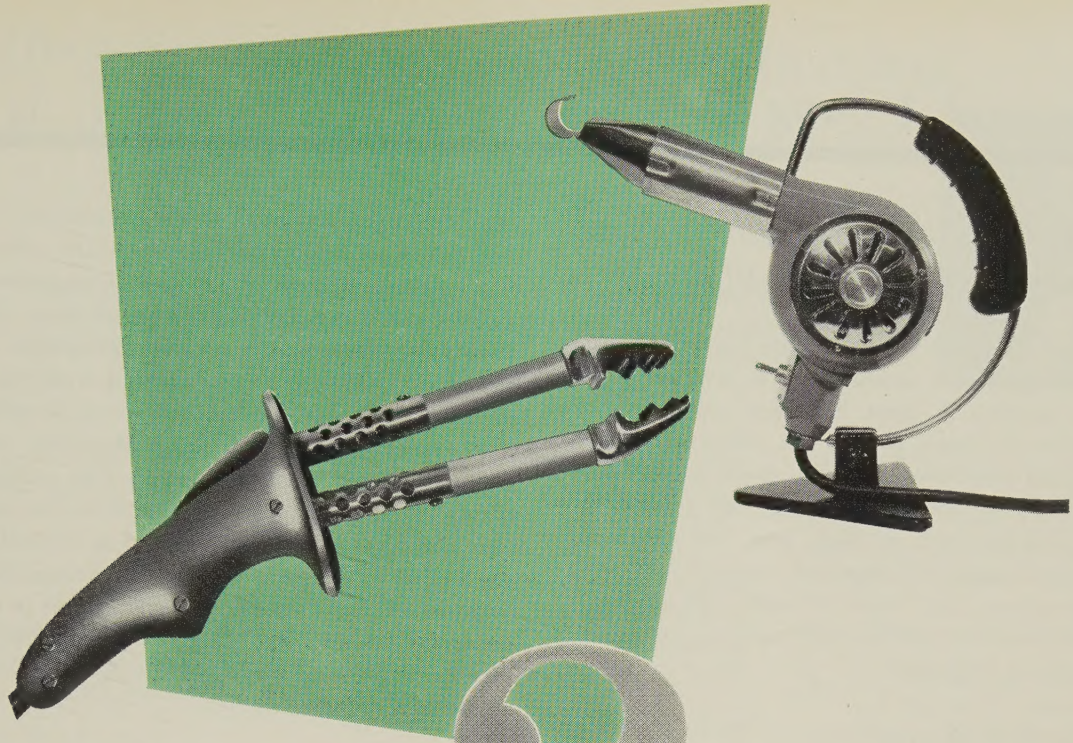
The Institute of Environmental Sciences held their 1960 Annual Meeting and Equipment Exposition at Los Angeles last month. In the announcement of the excellent program, some points worthy of thoughtful consideration were made by the Technical Program Chairman Neal Granick, physicist with the Wright Air Development Div., Air Research & Development Command. Mr. Granick explained that for the Institute the meeting marked the first time a "commentary-type" introduction was used to begin the discussion of technical papers and the topics covered by the authors. To assure the success of the meeting, he requested the cooperation of the audience in voluntarily applying the following rules which he labeled "The Ten Commandments of Discussion":

1. Confine your remarks to areas designated by the commentator who is also the discussion leader for the paper.
2. Keep this question uppermost in mind: what have *you* learned in your own investigations that would clarify, support, refute, or extend the work presented by the author?
3. By all means ask questions; but, before you do, make sure the answer isn't in the author's preprinted article or in his references, if the reference material is well known.
4. Do not engage in dialogues with promising debaters unless you are certain that some *new* material will be revealed by this tactic. Although this practice usually is interesting and sometimes amusing, it nevertheless is wasteful of time which is severely limited.
5. Be cooperative in revealing what you know, or believe to be, new and useful information. *Participate*. Even a sponge has to be relieved of its water now and then to be a useful utensil.
6. If the discussion seems to lag in the areas laid down by the leader, ask him if you may open a new subject . . . but be sure you treat the same topic that the author does.
7. Prepare your thoughts *before* you request the microphone. Then speak slowly into the "mike," making certain that everyone in the room can hear you. Give your name and company affiliation before launching into your remarks.
8. Don't be a ham. Have your say; then hang up the telephone and let someone else have the line.
9. Above all, don't be frightened in the presence of all the brain power that seems to be in your session. Just remember that Moses was awed in the presence of the Lord . . . until, with the Lord's help, he accomplished miracles. If *you* have the goods . . . please . . . deliver!
10. Evaluate the program discussion. Please drop your suggestions in the designated boxes. Help us to make your next meeting better.

It seems to us that nearly all of the engineering, scientific, and technical societies could follow the ten commandments of discussion suggested by Mr. Granick. It appears that Mr. Granick has done a superb job of presenting the problems with solutions involved in discussion-type meetings. Certainly, some of the points he lists will be familiar to anyone who has ever attended a discussion-type meeting. It takes only a few people to start things off and make such a meeting outstanding . . . and only a few people to ruin such a meeting.

Our Apologies

The editors did not realize how much interest *Insulation's* readers have in the subject of radiation. In the March issue, reprints of the article, "The Effects of Radiation on Materials" by V. J. Linnenbom, which had appeared in the January, February, and March issues, were offered along with a previous reprint "Radiation Effects on Insulation, Wire, and Cable" by C. J. Lyons and R. I. Leininger which appeared in the May and June 1959 issues. *Insulation's* Reader Service Department was literally deluged with requests for both reprints and our supplies of the 1959 article were rapidly exhausted. So to all of those who did not receive the 1959 article reprint—our sincere apologies.



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News and Views

Allied Chemical to Manufacture New Group of Fluorocarbon Plastics

The General Chemical Div. of Allied Chemical Corp. has announced plans to manufacture a new group of fluorocarbon plastics. A plant has been authorized at General Chemical's Baton Rouge, La. center. The first product planned is a non-flammable thermoplastic material based on chlorotrifluoroethylene. The product is said to be characterized by high heat and chemical resistance, good electrical properties, exceptionally low moisture absorption, high impact strength, and excellent machinability. It can be fabricated by injection, extrusion, and other molding techniques.

G-E Sells Alkyd and Polyester Resin Plant

Sale of its alkyd and polyester resin manufacturing plant, located at Anaheim, Cal. to Oronite Chemical Co., San Francisco, has been announced by the Chemical Materials Dept. of General Electric Co. Purchase price was not revealed. G-E states that as a result of the sale, the Chemical Materials Dept. will increase its concentration on the manufacture of phenolics, poly-carbonates, and fused magnesium oxide.

The Chemical Materials Dept. at G-E has also revealed that non-exclusive licenses under G-E United States patent No. 2,888,424 directed to the manufacture of filled, chemically cross-linked polyethylene will be made available on reasonable terms. Wire and cable insulation, hot-strength films and tapes, and molded industrial parts are among the many applications for which the materials are said to be especially suitable.

Marbon Cuts ABS Plastic Prices

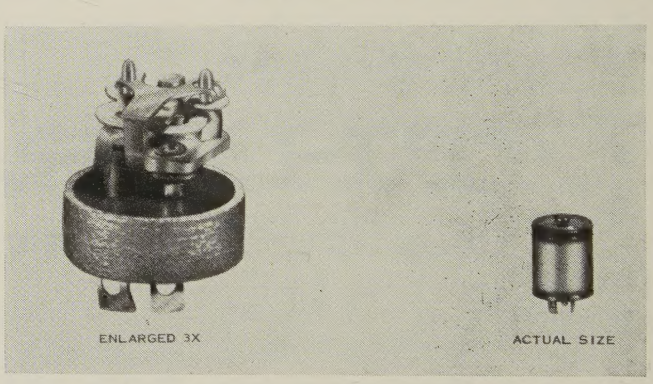
Healthy reductions in the price of Cycolac ABS plastic have been announced by Marbon Chemical Div. of Borg-Warner Corp. The reductions amount to 7 to 9 cents per pound.

Phenolic Insulation Still Growing

According to a recent market report by Richard H. Bruce, product sales manager for phenolics at Union Carbide Plastics Co., Div. of Union Carbide Corp., the oldest synthetic plastic, phenolic, is still one of the liveliest. Sales for the industry topped the half-billion pound mark in 1959 for a 23% increase over 1958. According to Bruce, electrical and electronic insulation applications have accounted for much of the growth and he cites the fact that without phenolic as a dielectric, there could be no electrical, automotive, radio, and television industries as we know them today. Bruce's report shows that molding compounds accounted for about 207-million pounds of phenolic in 1959. It is estimated that of this total, 44-million pounds went into wiring devices, 38-million pounds into general electrical devices, 24-million pounds into appliances, and 12-million pounds into automotive electrical devices. In addition, about 25-million pounds went into non-decorative laminates. About 49-million pounds are used as protective coating resins. Two of the relatively new uses of phenolics are their application in missile nose cones and the use of a phenolic impregnated paper cell divider in place of the wood dividers formerly used in automobile storage batteries.

Smallest Hermetically Sealed Switch

Weighing less than 1/28th of an ounce, a new switch made by the Spencer Products Group, Metals & Controls Div., Texas Instruments Inc., is claimed to be the lightest and smallest hermetically sealed precision switch of its



type on the market. Prior to being hermetically sealed, the switch is filled with a dry inert gas to insure reliability. Terminals are brought out through a fused glass seal to make the assembly completely environment free.

New Bus Bar Insulator Strip

A new type of bus bar insulator strip made from a rigid vinyl multi-channel extrusion reportedly is now being used in analog computer consoles and in associated electronic equipment. This strip is designed to insulate and retain the full length of six strip-type bus bars of various voltages used for power supply and control. Made by Rotuba Extruders Inc., Brooklyn, from a B. F. Goodrich Chemical Co. vinyl compound, the channel strips are claimed to simplify installation, shorten assembly time, reduce weight, conserve space, lower cost, and function as wire separators.

Heat-Resistant Varnish Solves Bonding Problem in Small High-Speed Motors

An interview with Robert M. Henry, District Sales Manager
Schenectady Varnish Company, Inc., Schenectady, N. Y.

Impregnating varnishes used in more efficient, small high-speed motors must hold the coils rigidly in place despite higher operating temperatures. As described below ISONEL 31 Polyester Varnish shows outstanding bond strength in Helical Coil Bond Test.

Q. What is the significance of the bonding strength of an insulating varnish?

A. In rotating equipment this is a measure of its ability to hold the coils of a motor in place without cracking or losing adhesion—despite severe environmental stresses.

Q. Is there a standard test for this?

A. A number of methods have been devised — splints, bundles, screwhead and Helical Coil are the best known. The latter is relatively new, but is in wider use because it more closely resembles the actual insulating varnish bond in electrical equipment.

Q. Why is bond strength emphasized for the newer small motors?

A. It applies equally to motors of all sizes, of course. In small motors though, as operating temperatures rise, conventional varnishes deteriorate, coils are spun loose at high speeds and failures result. The Helical Coil Bond Test provides reliable data on the ability of a varnish to maintain its bond strength at temperatures of 155 C or more.

Q. Since practically all rotating equipment involves both a magnet wire enamel and an impregnating varnish, is this test useful for both?

A. Yes, considerable data has been accumulated for various varnish/enamel combinations in our Electrical Testing Laboratory, some of which is shown at right.

Q. Which combinations seem best suited for small motors?

A. In tests of various magnet wire enamels with a polyester varnish, a polyvinyl acetal enamel showed the highest bond strength. (See Fig. 1). It was closely followed by a polyester enamel.

Q. How about other varnishes?

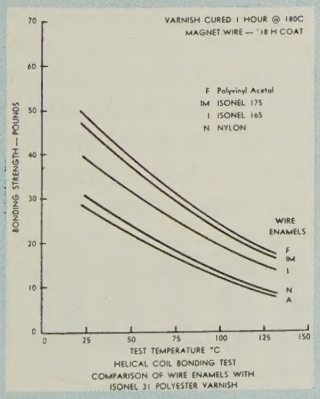
A. Because of their hardness, phenolic varnishes have been used mostly for small high-speed motors. In Fig. 2, however, you see the effect of heat aging on a phenolic vs. our ISONEL* 31 High-Bonding Varnish. Lower to begin with, the polyester increases in bond strength for over 200 hours at 200 C, before bond strength is affected.

Q. What is your conclusion, then?

A. It depends on the application, of course. In general, we believe best results on small motors are obtained with a polyvinyl acetal or polyester enamel with ISONEL 31 Varnish.

* *Reg. T. M., Schenectady Varnish Company, Inc.*

DIP-COATER applies ISONEL Varnish to enameled wire samples.



◀ **Fig. 1—Comparison of bonding strength of various wire enamels with ISONEL 31 High-Bonding Varnish.**

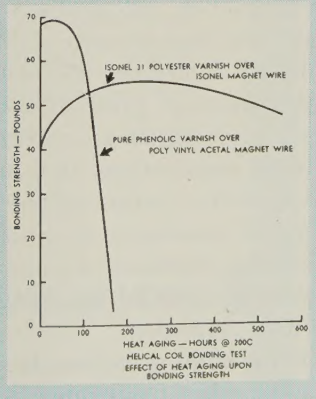


Fig. 2—Effect of heat aging on bonding strength of phenolic varnish and ISONEL 31 High-Bonding Varnish. ▶

** *Consult your wire supplier for data on ISONEL enameled wire.*

Inquiries should be directed to: Section E-03

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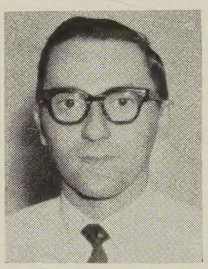
Insulation Forum

This regular monthly feature is built around a timely question concerning the electrical insulation field. Your suggestions for future questions and participation are invited. This month's question is:

What further property or test value information do you require for your electrical insulation applications—for example, do you lack property data under certain conditions of high temperature, humidity, radiation, etc. (and for which materials)?



J. Monturo

Engineer, Engineering Standards, Arma Div., American Bosch Arma Corp., Garden City, N. Y.

"In supplying electronic equipment for military usage, it is mandatory that materials used be capable of withstanding the military environment on demand without failure. Military environmental criteria are usually specified by detail equipment specifications and basic equipment specifications such as MIL-E-5400, MIL-E-8189, MIL-E-4158, etc. Those materials which are adequately specified via military specifications pose no problem since property and test value data in accordance with military test procedures are generally available. In general, materials not covered by military specifications lack test value information under military environmental conditions. As a user of insulating materials, I have found it difficult to obtain the following data from suppliers:

1. Electrical properties after exposure to humidity temperature cycling per Method 106, MIL-STD-202 and Procedure I, MIL-E-5272 (laminates, molded and cast plastics, coatings).
2. Electrical properties *at* maximum rated operating temperature (laminates, coatings).
3. Accelerated aging test data (epoxy formulations, paints, and other finishes).
4. Compatibility data (for instance, effect of epoxy coatings on sheet insulation).

"I feel that the aforementioned type of data would find widespread application in the military electronics field and would reduce repetitive testing by the users."

Marvin Brown

Manager, Motor Engineering, Airborne Accessories Corp., Hillside, N. J.

"In this age of supersonic craft, component manufacturers are continually striving to supply ever increasing output-to-weight ratios for limited periods of operation. To this end, the overstressing of materials becomes the rule, rather than the exception. Usually accepted terminology, such as class A, B, F, and H, have little meaning for such applications. Some particular areas where reliable data is quite limited, but would prove extremely useful, are as follows:

1. Dependable high temperature-limited life characteristics.
2. Mode of high temperature deterioration and intermediate residue effects.
3. Effects of extreme low ambient (—300° F) exposure.
4. Effects of total vacuum exposure.
5. Specific fatigue limits for cyclic

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Sorensen high precision AC regulators hold 60 cycle line voltage to ±0.01% for use in standards laboratories, for meter calibration and for other applications demanding a voltage source of highest accuracy and stability. Natvar Isoglas, used to insulate transformer coils has excellent thermal stability up to 155°C continuous operating temperatures.

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HIGH PRECISION AC VOLTAGE REGULATORS
are insulated with
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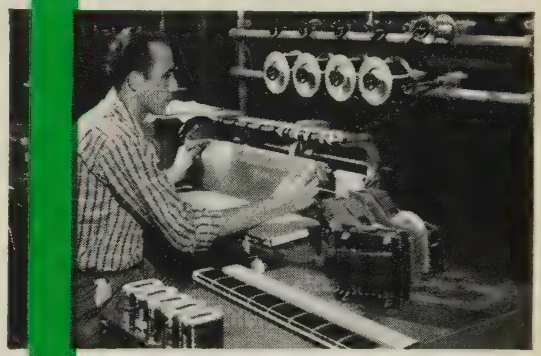

Eight coils are wound at a time on this multiple coil winder. Operators find Isoglas easy to use because it is always pliable, yet tough and scuff resistant.

Sorensen & Company, Inc., a subsidiary of Raytheon Company, manufactures a widely accepted line of controlled power equipment for research and industry — electronic and magnetic regulated AC and DC power supplies, regulators, stabilizers, frequency changers and inverters.

Materials are carefully selected, and must pass rigid inspection before they are accepted for production. Natvar Isoglas, a glass fabric coated with an isocyanate reacted resin, is used as interlayer insulation because of its excellent physical and electrical properties. It is strong mechanically and is resistant to transformer oils, Askarel, and other non-flammable insulating liquids, and to all solvents commonly used in electrical applications.

If you need insulating materials with good physical and electrical properties, and exceptional uniformity, it will pay you to specify Natvar, and get in touch with your wholesaler, or with us direct.

Natvar

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- Varnished silk and special rayon—sheet and tape
- Varnished papers—rope and kraft—sheet and tape
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- Slot cell combinations, Aboglas®
- Teraglas**
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- Isolastane® sheet, tape, tubing and sleeving
- Vinyl coated and silicone rubber coated Fiberglas tubing and sleeving
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- Styroflex® flexible polystyrene tape
- Extruded identification markers

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voltage, temperature, and nuclear stresses.

6. Compatibility with other insulation compounds.

7. Compatibiiity with hydraulic, lubricating, and coolant fluids."

S. T. Friedman

Physicist, Aerojet-General Nucleonics, a Subsidiary of the Aerojet-General Corp., San Ramon, Calif.

"The electrical insulation performance information most often lacking for my insulation applications is the effect on electrical insulation of prolonged exposure (100-10,000 hours) at high temperatures (800°-1700° F), and 100% relative humidity, to the combined neutron and gamma radiation produced by a nuclear reactor operating at 1-3 megawatts.

"Thermocouple insulation performance is particularly important since we are primarily concerned with small diameter (.062") metallic sheathed, MgO insulated thermocouples where the spacing between conductors is quite small and where thermocouple insulation failures can lead to both incorrect temperature measurements and eventual thermocouple failure and test cessation. Most product information will state the effect on the insulation of any one of the environmental conditions (temperature, humidity, neutron or gamma radiation) but rarely, if at all, is data given for the combined conditions to which the insulation will be exposed.

"I also have frequent need for information of the effect on the physical and electrical properties of subjecting insulated (particularly with MgO) thermocouples to rapid thermal cycling. Experience has shown that the different rates of expansion and contraction of the conductors, insulation, and sheath can result in insulation and TC failure. A parallel problem has been observed when open end sheathed couples are exposed to moist air at high temperatures. The insulation apparently interacts chemically with the wire to produce wire breakage in the immediate vicinity of the insulation. It would be very helpful if information about such problems were available instead of requiring exhaustive testing on the part of the user."

J. A. Turchan

Divisional Engineering, Chrysler-Imperial Div., Chrysler Corp., Detroit.

"Regardless of the field of endeavor, a question or problem often arises for which there is no apparent answer nor any qualified source that can be consulted for a positive solution. At this point, similar and comparative data on other subjects must be used to solve the problems confronting the design engineer, laboratory technician, and performance evaluation personnel.

"To achieve success, the individual must keep abreast of current material specification revisions and recommended practices within his scope of application.

"This is necessary in order to allow an individual to compound a proper solution from personal experience, rather than to rely on publications which are at times out of date since improvements develop very rapidly. This should not be misconstrued to say that current handbook information is of no value but rather that, as the question implies, certain new data is required.

"Let us discuss general purpose thermoplastic wire insulation. Current specifications on thermoplastic wire insulation have been covered within the Society of Automotive Engineers Handbook as adeptly as recent development criterion has allowed.

"However, it has been my experience with automotive applications of thermoplastic wire insulation that certain aspects are lacking within the currently available standards, and

therefore perhaps permit marginal considerations to be tolerated. As an example, how does a person convert the sandpaper abrasion test of thermoplastic wire insulation into terms of insulation gouging, a situation that is encountered in drawing cable through conduit. In some applications the protecting metal surfaces are smooth, others of course can be rough, as experienced in an automobile. This situation results from flanges, structural cutouts, and sheared edges.

"In addition, consider the merits of the flame test and high temperature test as opposed to the heat encountered in an engine compartment of an automobile on a length of thermoplastic insulated wire along which the temperature range can vary from –10° F to 250° F. To cope with this problem, it is necessary to apply the principles of knowledge and experience rather than presently available catalog information. But, will solutions rendered in this fashion give the engineer an acceptable answer to his problem?

"With the advent of the turbine propelled car, these three items will certainly need attention. The heat range of thermoplastic wire insulation will have to be adjusted to withstand the increased operating heat range of the turbine engine along with modifications in insulation durability. Surely these changes will be made, not as a demand of the automobile industry, but as a total necessity since thermoplastic insulated wire will be desirable for continued usage in the automotive field because of its intrinsic inexpensive value. Whereas in missile requirements, more durable types of wire insulation (nylon, 'Teflon,' etc.) are used to withstand adverse conditions at a proportionate increase in expenditure."

Carl Pomeroy

Senior Project Engineer, Scintilla Division, Bendix Aviation Corp., Sidney, N. Y.

"Fifteen years ago this question would have resulted in a pretty universal expression of dissatisfaction with the test data available from the insulating material manufacturer other than the standard mechanical,

physical, and electrical properties determined 'on standard laboratory specimens under standard laboratory conditions.' About the only environmental test conducted was water absorption and this test was used to predict the effects of moisture on everything from dielectric strength to fungus resistance.

"The situation today is vastly improved. The suppliers of insulating materials are becoming increasingly aware of the need for data under various environmental conditions and exposures and the release of a new material is usually accompanied by a wealth of information on the effects of high temperatures, humidity, chemicals, and the like. In most cases this information is adequate to indicate at least that the material warrants thorough testing.

"We must, therefore, admit that we feel the majority of insulating material suppliers are doing a good job in this respect. On the other hand, we doubt that their information will ever be so complete that we will not have many questions that require answering before a new material can be approved for critical installations."

G. D. Schindler

Head, Chemical Section, Clevite Electric Components, Div. of Clevite Corp., Cleveland, Ohio.

"As manufacturers of piezoelectric crystals and ceramics and magnetic recording devices, we make continuous use of a wide variety of insulating materials. Foremost among these are are the epoxy resins, employed in such diverse roles as adhesives, encapsulants, coatings, and basic structural elements. Second to the epoxies is a group involving silicones, vinyls, phenolics, rubbers and rubber-bonded materials, and more recently the polyurethane foams.

"Manufacturers' data on physical, electrical, and chemical properties provide a necessary starting point in the selection of an insulating medium. In underwater sound devices, for example, proper utilization of an epoxy resin encapsulant calls for knowledge of such basic characteristics as compressive, tensile, and flexural strength, coefficient of thermal expansion, volume resistivity, dielectric constant in the ultrasonic frequency range, maximum service temperature, the effect of salt and fresh water immersion, initial viscosity, cure shrinkage, and cure exotherm. This information is generally available from suppliers, however, it is useful only in a preliminary way. Detailed information must then be obtained regarding the effect of transmission of acoustic energy through the insulation. What portion of this energy is absorbed, what portion transmitted? How much heat will the absorbed energy generate and what will be its effect on the chemical and physical properties of the insulation? What fatigue effects will occur as the insulation at the face of the transducer resonates at frequencies ranging from 20 to 100 kc, with applied voltage as high as 3000 volts? How are these factors influenced by filled versus unfilled resins, rigid versus flexible resins? And how well will the original physical, electrical, and chemical properties of the insulation be maintained after prolonged exposure to this environment?

"It is realized that resin suppliers would be hard put to provide the information required for a final choice of materials; for this reason general manufacturers' information is used as a starting point and specific information required is developed in the laboratory. In many cases, compounds are formulated from basic materials to meet certain specific requirements and later these formulations are turned over to compounders as the volume of usage dictates. It seems unlikely in the foreseeable future that it will be possible to purchase all insulation needs solely on the basis of published data; the applications laboratory will continue to occupy a basic position in product development."

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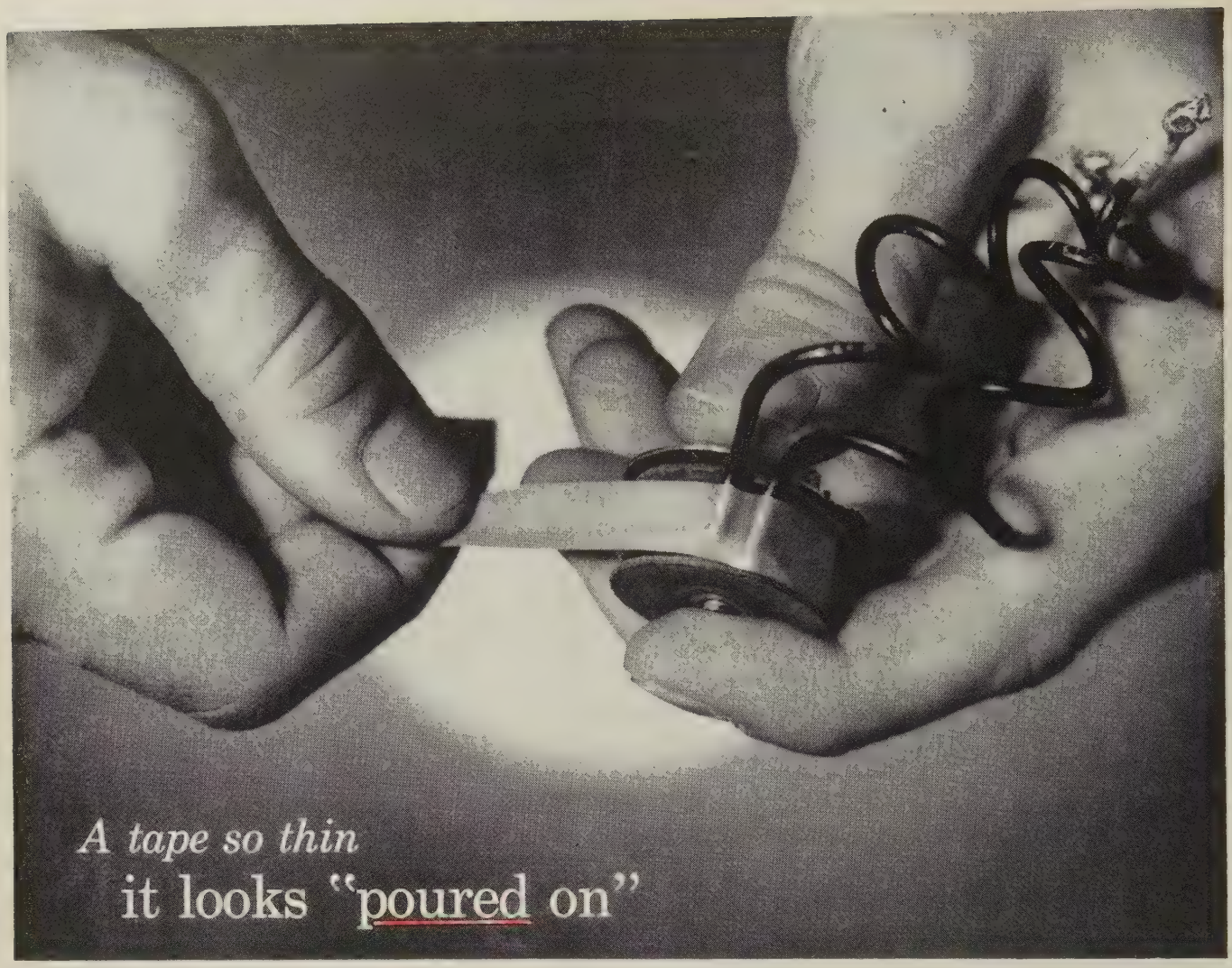

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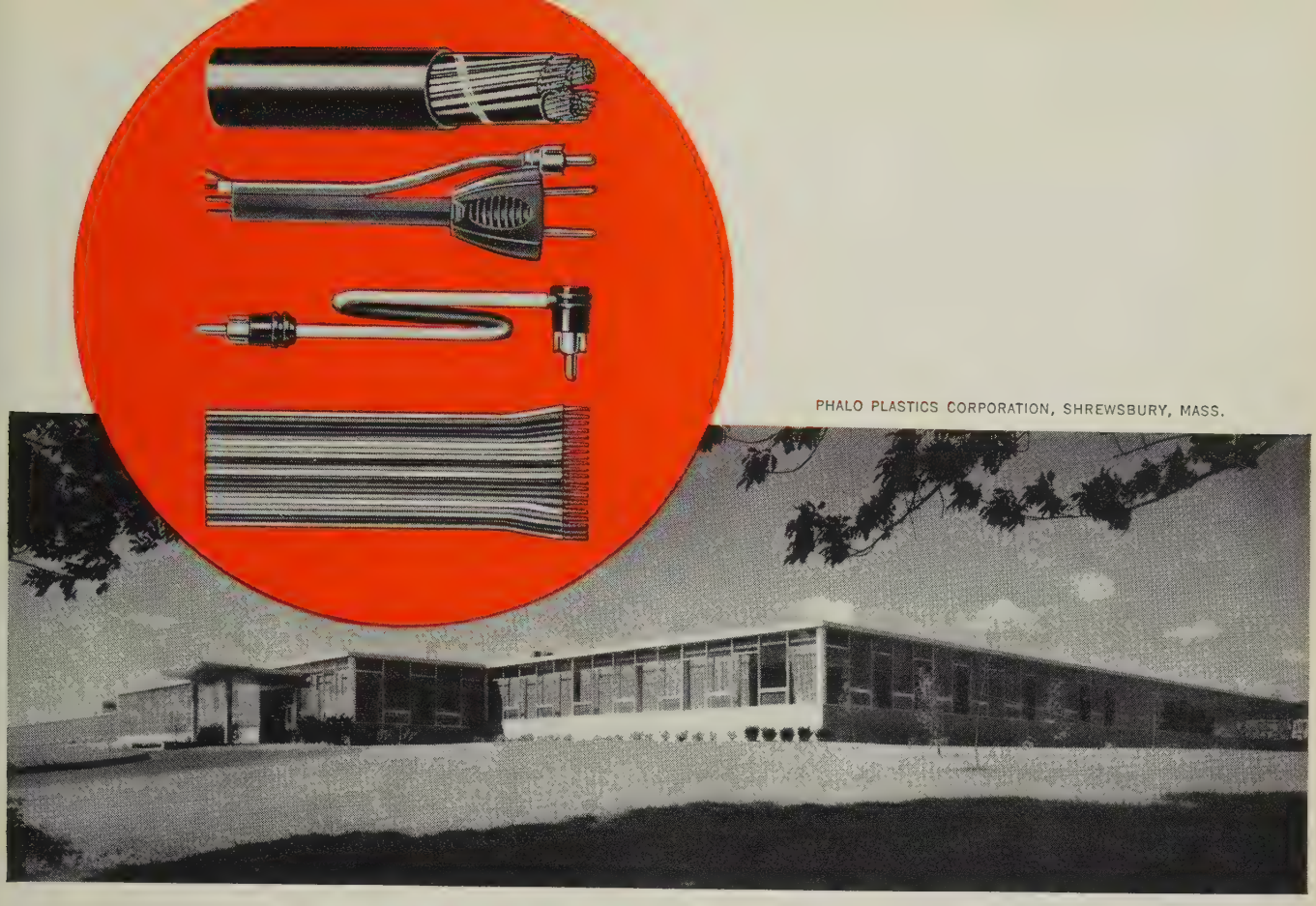

PHALO PLASTICS CORPORATION, SHREWSBURY, MASS.

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Phalo Plastics Corp., Shrewsbury, Massachusetts, a leading wire and cable manufacturer, and The Blane Corporation, insulation specialists, have teamed together to solve industry needs.

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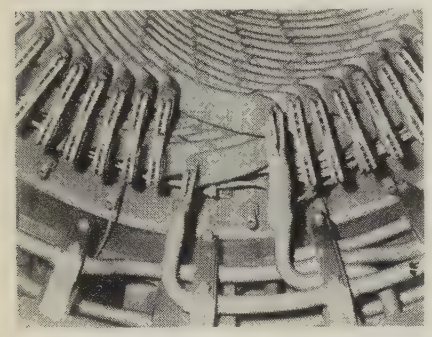
Hydrogen Cools Giant Coils

Shown in the photograph is a portion of an Allis-Chalmers Mfg. Co. steam turbine generator stator. Copper coil strands in the stator are transposed around a total of 6,000 feet of rectangular stainless steel tubing. Hydrogen gas passes through the tubing at velocities up to 10,000 feet per minute, transferring heat from the stator coils, keeping them at desirable temperatures. The tubing is supplied by Carpenter Steel Co., Alloy Tube Div. In the photograph, only the end openings of rectangular stainless steel tubing are visible in assembled stator coils.



Educational Awards by Du Pont Total $1,300,000

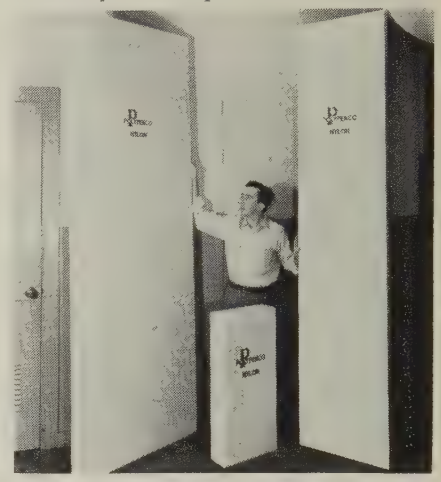
Grants totaling more than $1,300,000 have been awarded to 143 universities and colleges for the 1960-61 academic year in the Du Pont company's annual program of aid to education. The program is for fundamental research by universities, for strengthening the teaching of science and related subjects, and for facilities for education or research in science and engineering.

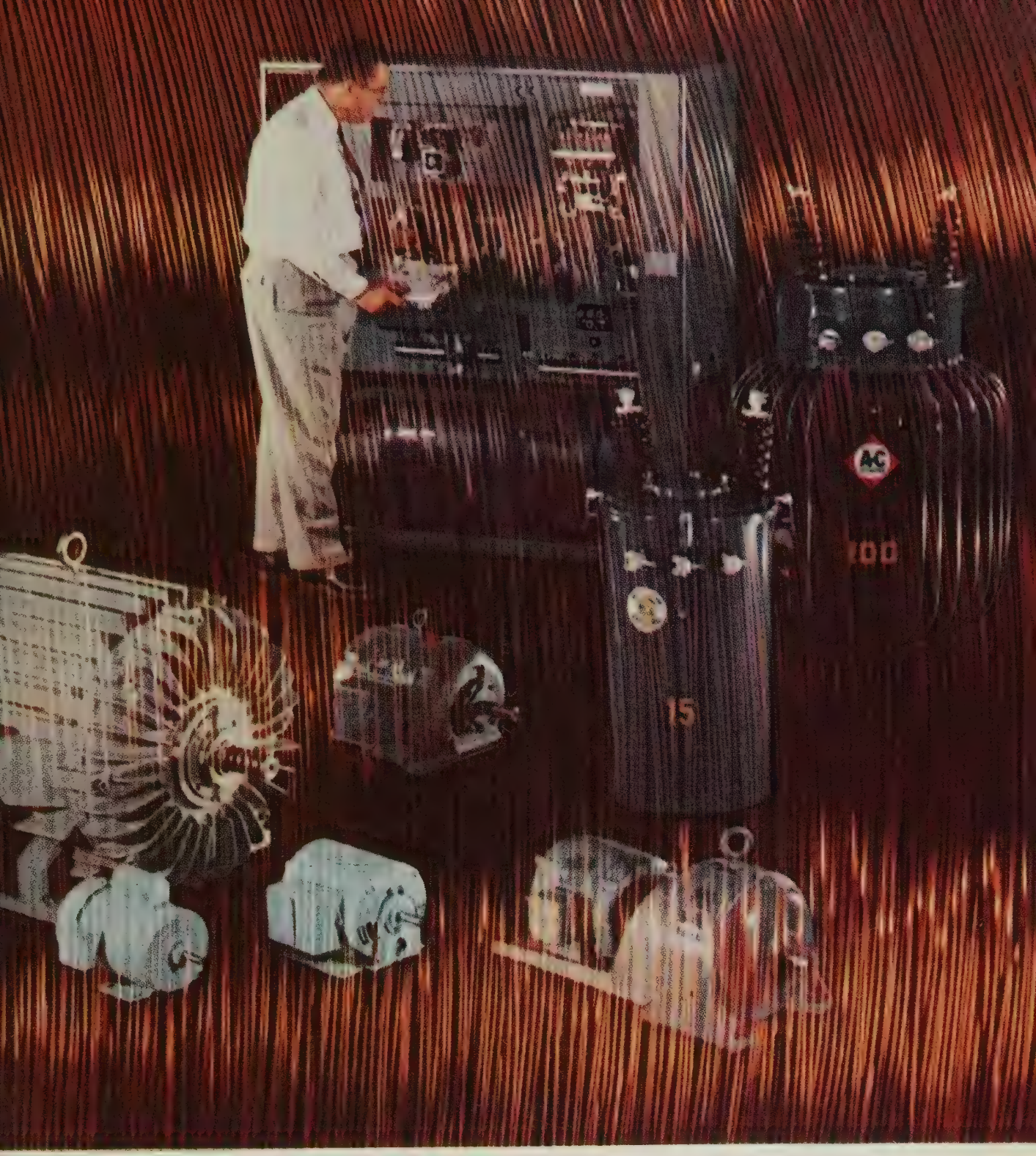
Temporary Adhesive For Nylon Parts

Small interlocking or interfitting parts of molded nylon, difficult to hold in place because of their slipperiness, can be made to adhere to each other temporarily during assembly with a drop of fluoroalcohol. The fluoroalcohol acts as a very mild solvent to soften the adjoining surfaces. The temporarily joined parts can be physically separated again by the light mechanical stress encountered in normal operation of the assembled unit. The C3 fluoroalcohol is supplied by DuPont.

Massive Nylon Shapes

Massive nylon symmetrical shapes, the largest yet produced, weighing up to 400 pounds and measuring 36″ in width, 2⅝″ in thickness, and 102″ in length, are now being produced by The Polymer Corp.





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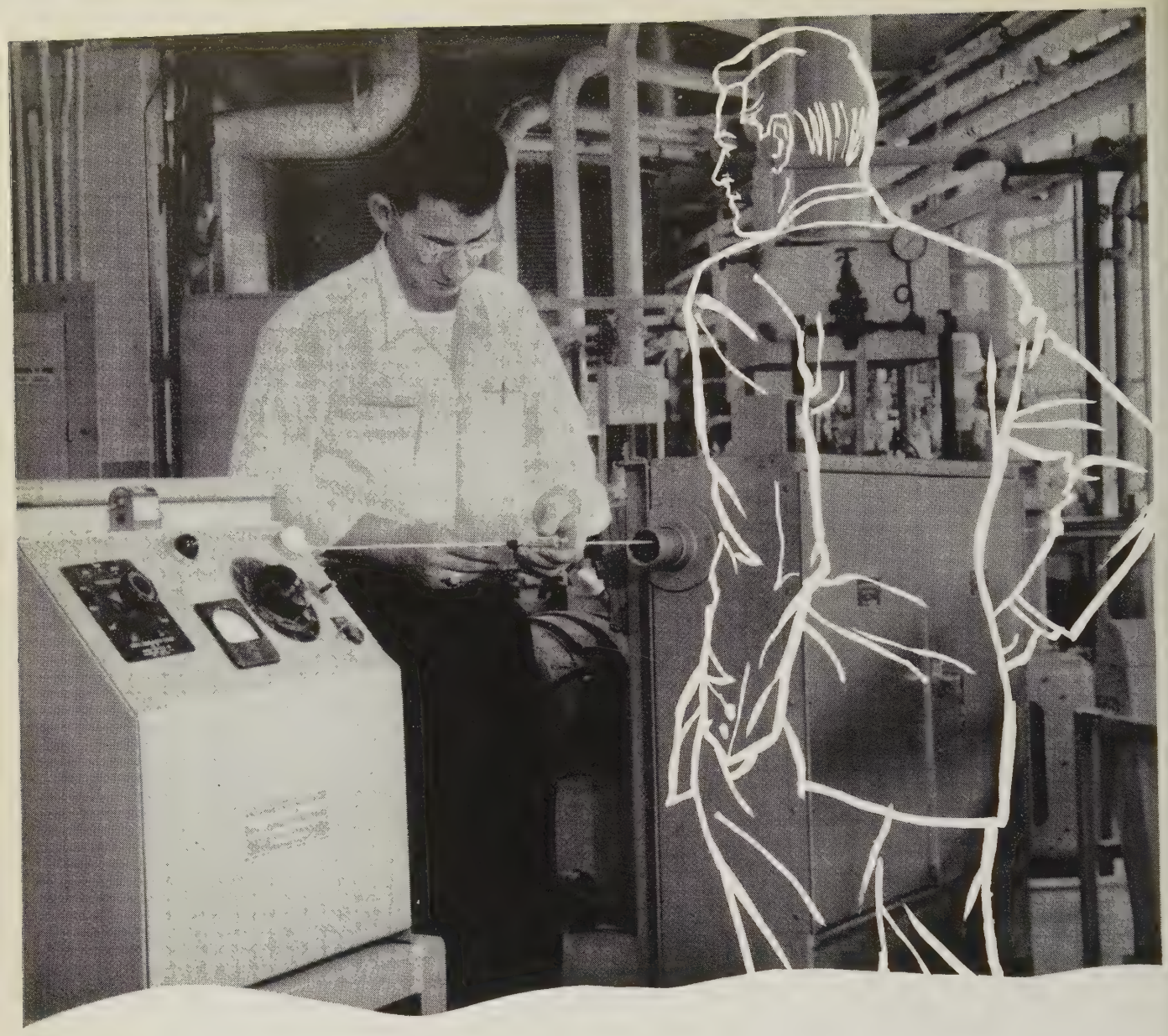

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Both silicones have outstanding retention of tensile strength and elongation after prolonged exposure to high temperature. Both have dielectric strength of 1000 volts/mil. Both can be cured with either steam or hot air. And both are low shrink compounds. K-1347 ... for premium properties. K-1357 ... for economy.

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Arc and Track Resistance Tests

By J. Chottiner, Materials Laboratory, Westinghouse Electric Corp., East Pittsburgh, Pa.

An important requirement for electrical insulating materials in many applications is that these materials have a high degree of resistance to carbonization when directly exposed to an electrical discharge or when subjected to excessive leakage current across the surface due to the presence of surface contaminants.

Materials which have a high degree of resistance to visible electrical discharges are said to have good arc resistance. Those materials which resist carbonization due to the effect of leakage current are said to have good track resistance. Visible discharges may be observed in the latter case in the form of minute scintillations. In a sense the two terms are synonymous, since the mechanism of failure in both cases is the thermal degradation of the insulating material or one or more constituents of the insulating material to a carbonaceous ash. The carbonaceous residue thus formed permits the flow of excessive current across the insulating member and often results in the failure of the equipment involved.

Tracking Failures

Tracking failures usually occur where the potential difference between the failure points is not sufficient to cause an electrical breakdown of the air gap separating the two points. We usually associate such failures with conditions where surface moisture and contaminants coupled with sufficient potential cause the flow of leakage current. The passage of leakage current through the surface film causes heating and evaporation of the surface moisture. This results in small air gaps which are bridged by small electrical discharges, usually referred to as scintillations. These scintillations tend to thermally degrade the insulation and initiate a carbon track. Repeated and prolonged exposure to these conditions results in the lengthening of the original track until a complete carbon track is formed between points of different potential.

Arcing Failures

Arcing failures of insulation are usually found where such insulation is exposed to an electrical discharge which bridges the entire gap between points of different potential. This type of discharge is most often produced in equipment in which contact points are opening and closing. If the discharges are repeated or prolonged, sufficient thermal degradation takes place to carbonize the surface of the insulation, causing it to become conductive.

Considerable effort has been expended by the electrical and associated industries to develop insulating materials with improved arc and track resistance. One of the obstacles which has impeded the development of improved materials has been the lack of a good test method for evaluating experimental materials. Existing test methods are not completely satisfactory, either because of poor correlation with field experience, costly equipment requirements, special power facilities, poor reproducibility of results, or lengthy test cycles.

ASTM Arc Resistance Test Results

The bulk of the published data on the arc resistance of insulating materials is in the form of ASTM Method D495-52T arc resistance values. Functional testing and field experience have shown poor correlation with ASTM arc resistance test results. In part, the poor correlation of ASTM arc resistance test results with field experience can be attributed to differences in intensity of exposure. The ASTM tester uses a 12.5-kv potential and a maximum 40-milliampere current to produce an electrical discharge over a ¼-inch air gap between the electrodes. The maximum power developed in the discharge is 375 watts. This power is exceeded in most arcs or electrical discharges which are produced in the functioning or malfunctioning of electrical apparatus. The short circuit current which activates a low power (110-440 volts) circuit breaker may reach many hundred amperes. Even with only normal current flowing, the current flow through such a breaker gives electrical discharges higher in magnitude than those developed in the ASTM test method. The intensity of the electrical discharges produced in the operations of high voltage switchgear equipment is of course many times greater than that produced in the ASTM test.

If we were to assume that ASTM arc resistance values gave a true indication of the relative arc resistance of materials, we would find it difficult to explain why certain phenolic materials show superior arc resistance to amino resin bonded materials on the ASTM test when the reverse is true in actual application of these materials. The reproducibility of results obtained with ASTM Method D495 is in general acceptable. Poor reproducibility of results is usually encountered with the poor arc resistant materials such as the phenolics which normally give values of less than 120 seconds. Great care must be exercised in this range (less than 120 seconds) to use clean electrodes. Carbon residue on the electrode tips greatly accelerates failure of the specimen. An effort is now being made to evaluate the effect of strip electrodes on the reproducibility of results in the ASTM D495 test method. Indications are that some improvement in reproducibility of results can be obtained with strip electrodes.

Dust and Fog Test

The Dust and Fog Test[1] is currently receiving considerable attention as a test method for evaluating the wet tracking resistance of insulating materials. There is a good possibility that this test will be accepted as a standard wet tracking test by the ASTM. A round robin test program is in progress to determine the degree of correlation of test results obtained with the test units at several different companies and locations. It is antici-

pated that an analysis of the round robin results will help to determine the degree of reproducibility with this test method and also serve to more clearly define test conditions, specimen sizes, and control factors related to the test.

Some preliminary testing with this test method has indicated that reproducibility of test results will be somewhat poorer than is desirable. The principle disadvantage of the Dust & Fog Test in its present form is the length of time required to reach an end point of failure by either tracking or erosion with good track-resistant materials. Many track-resistant materials are subjected to test for periods in excess of 100 hours without failing. Where limited test facilities are available, this reduces the number of specimens that can be tested in a reasonable length of time. Where failure by erosion precedes failure by tracking, the question of specimen thickness becomes significant. This question of the relationship of specimen thickness to erosion and tracking will have to be resolved.

High Power Arc Resistance Test

We have found the High Power Arc Resistance Test[2] gives good correlation with many field application results. This test method has one major drawback in that special power facilities are required to produce the 500-volt potential with 500-ampere current. The test is relatively simple to conduct and it requires relatively little time to reach a test end point.

Two ½-inch diameter graphite electrodes are placed on the surface of the specimen to be tested. A 500-volt 500-ampere d-c power source is used. Because the 500-volt potential is not sufficient to break down the ½-inch air gap between the electrodes, a piece of copper fuse wire is placed on the surface between the electrodes and is clamped in position under the electrodes. The copper wire helps to initiate the arc which can then be sustained by the potential difference through the ionized air path. The duration of the arc is preset with a timing device to interrupt the circuit. Normal exposure time is approximately 1/10-second. After each arcing exposure, power is reapplied to the electrodes (500 volts) to determine whether the surface has become conductive. If the surface is conductive under the 500-volt potential, the specimen is considered to have failed. If the surface is not conductive, the arc procedure is repeated. Specimens are rated according to the number of arcs (shots) to which they have been submitted. Highly arc-resistant materials are eroded through before failure occurs.

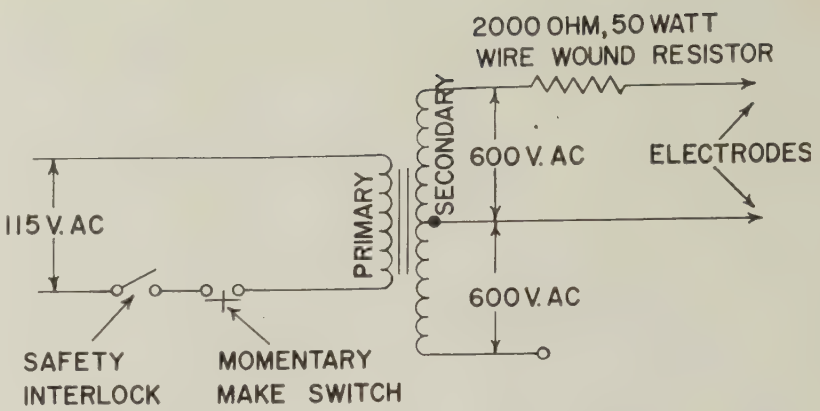

Figure 1, circuit diagram dry linear tracking resistance tester.

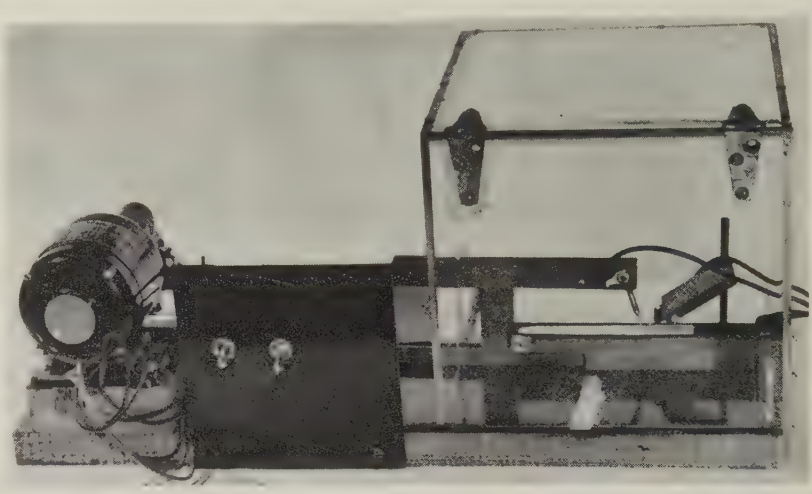

Figure 2, dry linear carbon tracking resistance tester with electrodes in position for start of test.

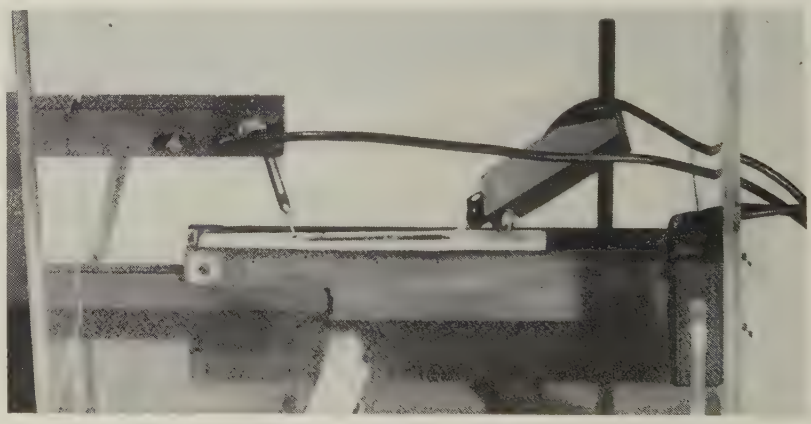

Figure 3, dry linear carbon tracking resistance tester showing carbonized track at end of test.

Electrolyte Drop Tests

The European electrical industry has been inclined to adopt track resistance test methods which involve the regulated dropping of an electrolyte material between fixed electrodes on the surface of a test specimen and measuring the relative track resistance of materials as a function of the number of drops of electrolyte and the potential between the elec-

trodes necessary to produce failure by tracking. The tentative test method TC15[3] of the International Electrochemical Commission is a good example of this type of test method. Similar tests have been evaluated by our own electrical industry. Tests such as the Nekal Drop Test[4] and the Detroit-Edison Test[5] have been found to give very poor reproducibility of results and have found relatively little use in recent years.

Many other arc and track resistance test methods are employed throughout the electrical and allied industries. These tests are in many cases tailored to suit a specific application problem and consequently cannot be used in the general evaluation of materials.

Whether a single test method can be developed which can be used to evaluate electrical insulating materials for arc and track resistant properties over the wide range of conditions encountered in application appears to be very doubtful. It is more likely that a series of tests will have to be employed to give a nearly complete analysis of the arc and track resistant properties of an insulating material.

Dry Tracking Test Method

In an effort to obtain additional data on test methods which might be of value in developing improved test methods, a dry tracking test method which has received limited study was more completely evaluated. This test employs the principle of measuring the inherent resistance of an insulating material to formation of a conductive carbon path under the influence of a relatively high surface conducting current.

This test method has been designated by us as the Linear Dry Carbon Tracking Resistance Test. Preliminary work on this test method was performed at the Ducan Electric Company by Mr. R. A. Road and also by Rostone Corp. The electrical circuit for the tester is shown in figure 1. The unit is connected to a 115-volt a-c line source. The voltage is stepped up to 600 volts through the center tap of a Thordaison type T-22R-36 plate power transformer. A 2000-ohm, 50-watt, wire wound resistor is connected in series to limit the line current during short circuit. Two safety interlock devices are placed in the circuit to eliminate the danger of electrical shock to operating personnel inadvertently touching the electrodes while power is on. These include a safety interlock switch at the door of the cage which houses the electrode assembly and a momentary make switch which must be depressed to complete the circuit.

Two tungsten electrodes are used to initiate the original carbon track and subsequently lengthen this track. The electrodes are made from 3/16-inch bar stock with the electrode tips ground to give a phonograph needle type point. One electrode is mounted in a "Micarta" plate which is positioned on a support to permit it to be pivoted in and out of position. This electrode is referred to as the stationary electrode. The second electrode is spring loaded and mounted

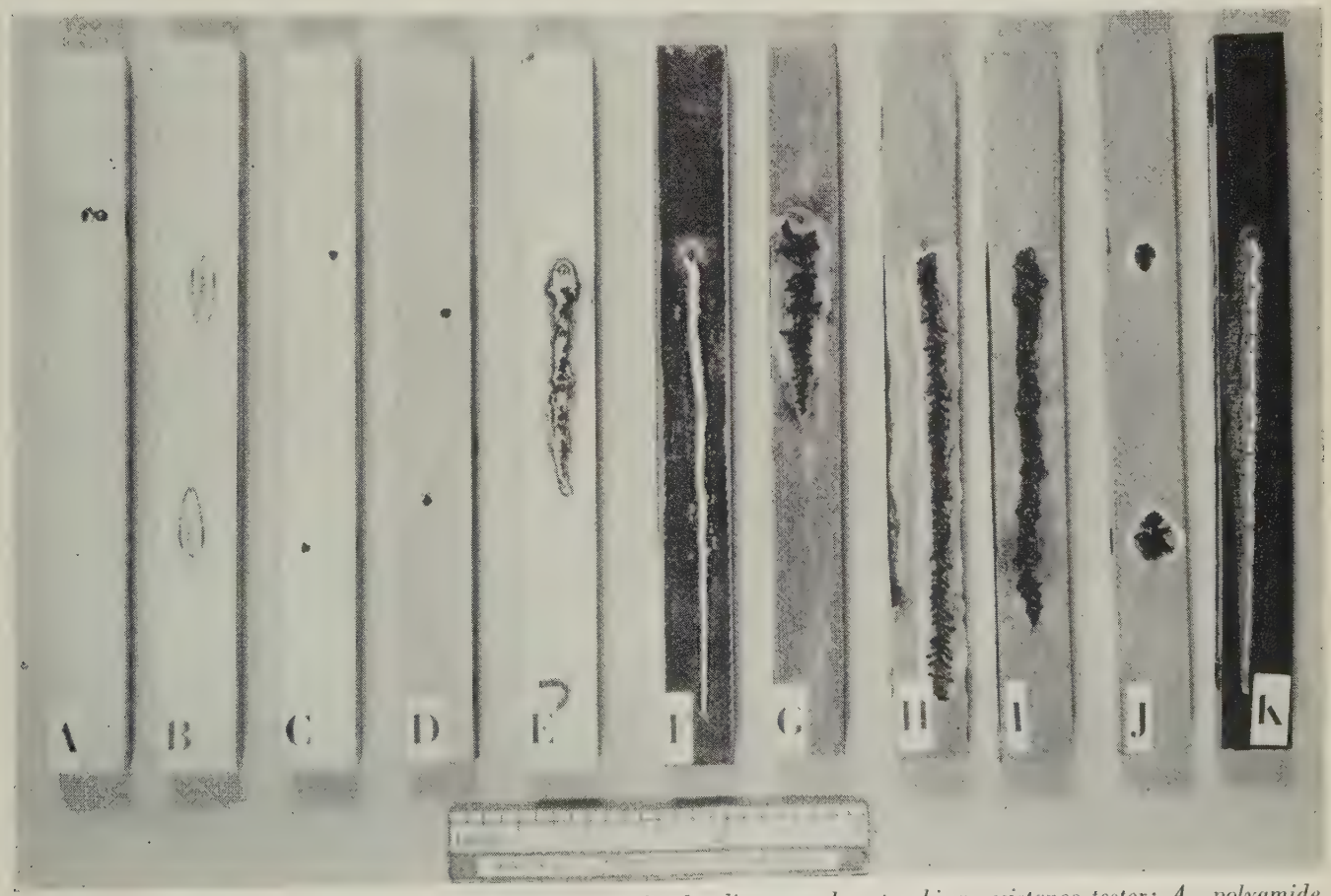

Figure 4, typical formed tracks on specimens tested on the dry linear carbon tracking resistance tester: A—polyamide, B—melamine-asbestos (cold mold), C—urea-cellulose, D—urea-cellulose. E—melamine-glass, F—phenolic-mineral, G—melamine-glass, H—melamine-wood flour, I—melamine-wood flour, J—melamine-cellulose, and K—phenolic-mineral.

in a Micarta holder which is attached to a drive mechanism. This holder can also be pivoted into and out of position. The second electrode is referred to as the moving electrode.

The drive mechanism consists of a screw powered by a Bodine 1/50-hp reversible motor. The screw is inserted into a threaded tube which also carries the moving electrode holder at the opposite end. A lug is welded to the tube and rests in a fixed channel track to prevent the tube from rotating with the screw.

A test specimen holder in the form of a channel is mounted on the base plate under the electrode assembly. The standard size specimen for the test is a ½-inch x ½-inch x 5-inch bar. The electrode assembly is enclosed in a "Plexiglas" cage to provide both safety and visibility during testing.

Table 1, Correlation of Test Results of Dry Linear Carbon Track Resistance Test With High Power Arc Resistance Test and ASTM Method D495 Test Results

Insulating Material	Linear Track Resistance (inch)	High Power Arc Resistance (shots)	ASTM Method D495 Arc Resistance (Sec.)
1. Urea-cellulose A	N.T.**	30h***	80-100
2. Polyamide	N.T.	37h	130-140
3. Acetal	N.T.	43h	129
4. Urea-cellulose B	N.T.	—	—
5. Melamine-cellulose A	0.20	9h	145
6. Melamine-cellulose B	0.25	33h	122-128
7. Melamine-cellulose C	0.30	8	122-128
8. Melamine-cellulose D	0.30	2	115
9. Melamine-asbestos*	0.50	30h	300+
10. Urea-asbestos*	0.65	30h	300+
11. Melamine-asbestos	0.70	46h	135-174
12. Mod. phenolic-mineral*A	0.70	2	292
13. Melamine-glass A	1.15	30h	183-186
14. Mod. phenolic-mineral*B	1.65	42h	305
15. Melamine-glass B	1.70	29h	183-186
16. Mod. phenolic-mineral*C	1.95	48h	245
17. Polyester-mineral*	2.00	47h	300+
18. Phenolic-mineral*A	2.15	2	240
19. Mod. phenolic-mineral*C	2.40	30h	—
20. Phenolic-mineral A	2.45	2	195
21. Polyester-mineral	2.50	20h	180
22. Phenolic-mineral*B	2.70	2	200-240
23. Mod. melamine-cellulose	3.25	6	71- 93
24. Phenolic A	3.15+	1	150
25. Phenolic B	3.25+	1	180
26. Phenolic C	3.15+	5	142
27. Phenolic D	3.20+	2	180
28. Phenolic E	3.15+	5	180
29. Phenolic-mineral B	3.00+	2	180
30. Phenolic-mineral C	3.25+	1	150
31. Melamine-wood flour A	3.20+	3	125
32. Phenolic-mineral D	3.25+	2	—
33. Melamine-wood flour B	3.05+	1	73-106

**Experimental cold molding formulations.*
***N.T. denotes original track could not be lengthened on tester.*
****"H" denotes that specimens failed by erosion rather than tracking.*

Test Procedure

A specimen to be tested is placed in the holder provided. The stationary electrode is positioned on the test specimen. The moving electrode is brought into position so as to make contact with the stationary electrode on the surface of the specimen. The tester is shown in this position in figure 2. The door to the cage is closed and the momentary make switch is depressed. The electrical discharge produced at the points of the electrodes will cause the surface of the specimen to carbonize and become conductive. The time required to carbonize the specimen will depend upon the inherent arc resistance of the material being tested. A visual inspection of the area exposed to the discharge and the behavior of the discharge will indicate when the surface of the specimen has carbonized to a degree so as to become conductive. Power is then applied to the screw drive and the moving electrode is separated from the stationary electrode at a rate of 1¼ inches per minute. The original carbonized area will continue to lengthen into a conductive path as the moving electrode separates from the stationary electrode until sufficient resistance is formed in the track to break the circuit. The tester is shown in this position in figure 3.

During the test, visual observations are made of the behavior of the material at the points of the electrodes and along the formed track. After the test has been completed, the specimen is removed from the specimen holder and the length of the track is measured. Our existing tester permits the formation of a maximum track of 3½ inches. The electrodes are cleaned with emery paper and the unit is ready for another test. The drive is reversed and the moving electrode is returned to the starting position for the next test. Typical formed tracks are shown in figure 4.

Evaluation of the Tester

To evaluate the performance of the Dry Linear Carbon Track Resistance Tester and to determine the degree of reproducibility of test results and the correlation of test results with results

from other test methods, a number of commercial and experimental arc and track resistant molding materials were tested. Test bar specimens (½-inch x ½-inch x 5-inch) were molded in accordance with the suppliers recommended molding conditions. All four sides of the test bar were tested on the Dry Linear Track Resistance Tester following the test procedure previously described. Test discs (4 inches diameter x ⅛-inch thick) of each material were also molded and submitted to the High Power Arc Resistance Test.[1] Data on the ASTM Arc Resistance, Method D495, were taken from the published literature of the suppliers. The results of the evaluation program with respect to correlation between test methods are shown in table 1.

In general, correlation between test results obtained on the Dry Linear Tracking Resistance Tester and the 500-volt 500-ampere high power arc resistance test is good. Of the 17 materials tested on the DLTR test which gave tracks of 2 inches or less, only 3 failed by tracking on the high power arc resistance test. The other 14 materials failed by erosion on the high power arc resistance test. Of the 16 materials which gave tracks longer than 2 inches on the DLTR test, only 2 failed by erosion on the high power arc resistance test. The correlation of test results between either the DLTR test or the high power arc resistance test with the test results of these materials obtained using ASTM Test Method D495 is very poor.

The Dry Linear Carbon Track Resistance Tester offers some advantages over the high power arc resistance type testers. Relatively inexpensive equipment is required to build the test unit. Normal line voltage can be used as an initial power source. No external medium such as a copper fuse wire is required to initiate arcing or tracking. The test may be observed while in progress, permitting the operator to ascertain differences in behavior between the materials under test. Less time is required to reach a test end point for highly track resistant materials.

As is shown in table 1, molding materials containing amino resin binders in general have good track resistance as determined by the Dry Linear Carbon Track Resistance Tester. The exceptions to this rule are the melamine materials containing wood flour filler which have poor track resistance. Polyester materials have fair track resistance and phenolic materials are generally very poor in track resistance.

It should be emphasized that this particular test rates materials under completely dry and contaminant-free conditions. Our own experience has shown that insulating materials in many cases demonstrate different tracking properties under dry and wet conditions. The degree of correlation with established wet tracking tests has yet to be determined.

Table 2. Reproducibility of Test Results on Dry Linear Carbon Track Resistance Tester

Insulating Material	No. of Test Results	High Value (inch)	Low Value (inch)	Average Value (inch)
1. Urea-cellulose A	2	N.T.	N.T.	N.T.
2. Polyamide	3	N.T.	N.T.	N.T.
3. Acetal	3	N.T.	N.T.	N.T.
4. Urea-cellulose B	3	N.T.	N.T.	N.T.
5. Melamine-cellulose A	4	0.40	0.10	0.20
6. Melamine-cellulose B	4	0.40	0.10	0.25
7. Melamine-cellulose C	4	0.45	0.25	0.30
8. Melamine-cellulose D	4	0.35	0.10	0.30
9. Melamine-asbestos*	7	0.50	0.50	0.50
10. Urea-asbestos*	8	0.85	0.35	0.65
11. Melamine-asbestos	6	1.30	0.35	0.70
12. Mod. phenolic-mineral*A	4	1.05	0.35	0.70
13. Melamine-glass A	4	2.00	0.35	1.15
14. Mod. phenolic-mineral*B	4	1.70	1.55	1.65
15. Melamine-glass B	7	1.85	1.60	1.70
16. Mod. phenolic-mineral*C	4	2.10	1.75	1.95
17. Polyester-mineral*	3	2.10	1.85	2.00
18. Phenolic-mineral*A	4	2.20	2.10	2.15
19. Mod. phenolic-mineral*C	4	2.50	2.25	2.40
20. Phenolic-mineral A	10	3.05	1.30	2.45
21. Polyester-mineral	4	3.00	1.60	2.50
22. Phenolic-mineral*B	4	2.85	2.30	2.70
23. Mod. melamine-cellulose	4	3.50	2.75	3.25
24. Phenolic A	4	3.20+	3.10+	3.15+
25. Phenolic B	4	3.30+	3.20+	3.25+
26. Phenolic C	4	3.20+	3.10+	3.15+
27. Phenolic D	4	3.25+	3.15+	3.20+
28. Phenolic E	4	3.25+	3.10+	3.15+
29. Phenolic-mineral B	3	3.00+	3.00+	3.00+
30. Phenolic-mineral C	3	3.30+	3.10+	3.25+
31. Melamine-wood flour A	4	3.30+	2.90+	3.20+
32. Phenolic-mineral D	4	3.45+	3.00+	3.25+
33. Melamine-wood flour B	4	3.40+	2.50+	3.05+

**Experimental cold molding formulations.*

References

1. *"Suggested Method of Test for Dust and Fog Tracking Resistance of Electrical Insulating Materials," Report of Committee D-9 on Electrical Insulating Materials, Appendix III, July 1957.*
2. *"A Test for High Power D-C Arc Resistance of Electrical Insulating Materials." M. M. Fromm, ASTM Bulletin No. 207, July 1955.*
3. *"Method for Determining the Comparative Tracking Index of Solid Insulating Materials Under Moist Conditions," Int. Electrochemical Comm., Geneva, Tech. Comm. 15, Document 15 (Central Office), Jan. 1957.*
4. *"The Drop Method for Evaluation of Tracking Resistance of Insulating Materials," W. Woebecken, Kunstoffe 42, 253 (1952).*
5. *"Trend of Power Cable Research in America," K. Wyatt, Elect. Power Engineers Assoc. Paper, Nov. 1938.*

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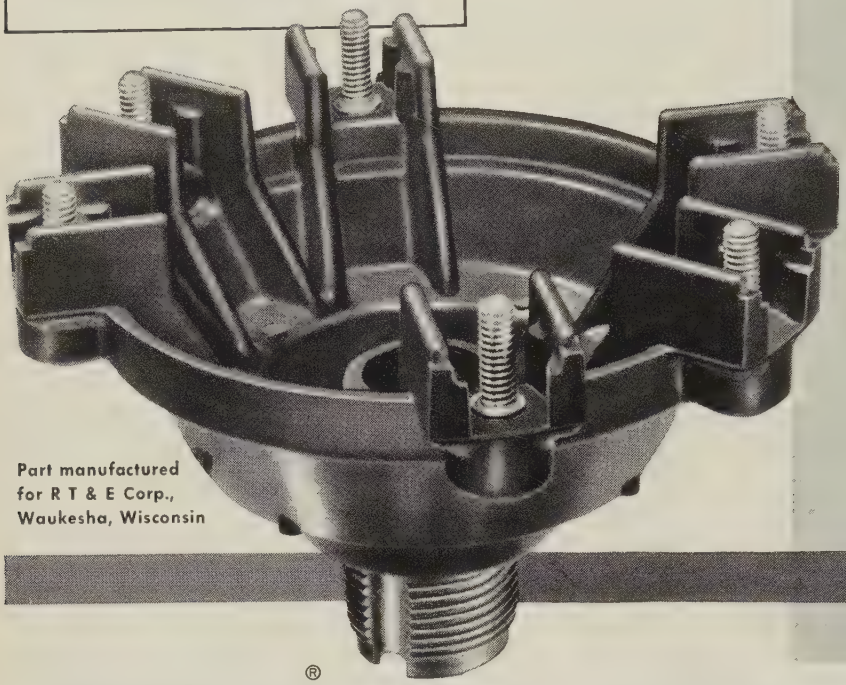

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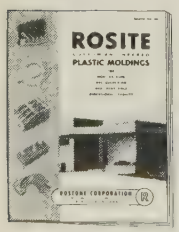

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Survey Uncovers Problems of Solidifying Fluids Insulation Users

In an attempt to learn problems that need solutions . . . and the answers to many other questions . . . *Insulation* recently sent a questionnaire to some 2,994 readers. The questionnaire dealt strictly with solidifying fluid insulations—those electrical insulation materials which are used or applied in a fluid form and which are subsequently converted to a solid, film, or foam form. The actual types of products with which the survey was concerned are described in many different ways such as impregnating varnishes, sealers, shellacs, waxes, resins, encapsulants, potting compounds, insulating enamels, embedding compounds, elastomers or rubbers for encapsulation, insulating pastes, etc. However, to avoid prejudicing the answers in the questionnaire, the term "solidifying fluid" materials was used throughout the questionnaire rather than using any of the previously mentioned terms.

The actual questionnaire form was single spaced and four pages long. A considerable number of questions were asked requiring answers varying from check marks to written com-

Table 1—Processing Improvements Desired

	Number	%
Total respondents using solidifying fluids	589	100.0
Users who did not answer question	31	5.3
Users suggesting one or more improvements	558	94.7

Processing Feature or Factor Improvement Desired	Number of Mentions According to Product Code of User*													Actual Mentions			
	A	B	C	D	E	F	G	H	I	J	K	L	M	Grand Total	Actual Number	% of Users (589)	% of Replies (558)
Flash point	16	24	11	5	3	4	5	6	6	2	7	3	....	92	38	6.5	6.8
Viscosity	28	111	45	36	4	15	19	35	40	40	23	8	1	405	154	26.2	27.6
Shelf life	62	129	53	40	4	20	32	48	47	45	40	13	2	535	204	34.6	36.6
Pot life	71	208	62	54	3	26	37	72	64	52	40	17	2	708	291	49.4	52.1
Evaporation	28	14	12	4	1	3	2	5	5	4	6	4	1	89	34	5.8	6.1
Settling of solids	36	72	40	28	5	12	17	32	23	24	15	8	1	313	110	18.7	19.7
Toxicity	28	106	33	37	3	19	26	43	37	33	24	7	3	399	152	25.8	27.2
More or less thixotropy	13	38	18	14	....	8	11	26	14	12	10	4	1	169	72	12.2	12.9
Coatability	39	87	46	35	4	17	23	37	25	29	20	7	4	373	141	23.9	25.2
Drain time	19	24	6	5	2	4	....	2	3	4	1	2	..	72	32	5.4	5.7
Curing or drying time	80	169	65	71	7	30	39	50	56	54	41	13	5	680	285	48.4	51.0
Exotherm	16	71	22	26	1	5	23	28	41	24	21	5	1	284	114	19.4	20.4
Curing temp.	45	118	51	45	1	22	29	38	51	31	30	12	2	478	203	34.5	36.4
Melting temp.	13	25	26	16	....	7	6	23	13	12	8	8	....	157	64	10.9	11.5
Solubility	3	19	10	10	1	6	3	7	7	9	5	4		84	19	3.2	3.4
Solventless materials	29	47	21	17	2	5	13	27	22	18	12	8	..	221	89	15.1	15.9
Water solubility	15	23	18	7	2	4	5	10	11	11	4	4		114	37	6.3	6.6
Color	6	16	10	4	....	1	6	7	8	5	5	2	1	71	32	5.4	5.7
Bubbling	35	97	45	38	3	13	26	44	45	37	26	11	1	424	165	28.0	29.6
Dispensing	16	81	30	31	3	17	22	40	32	22	19	6	....	319	102	17.3	18.3
Mixing	13	78	39	28	1	15	25	39	43	35	25	5	1	347	118	20.0	21.2
Shrinkage during cure	55	132	50	41	2	18	40	56	60	47	41	15	2	559	227	38.5	40.6
Deaerating	14	68	17	24	1	9	21	30	34	22	12	3	2	257	106	18.0	19.0
Obnoxious volatiles	20	50	29	27	2	11	16	21	27	19	20	5	....	247	89	15.1	15.9
Foam control	5	32	9	12	....	6	10	8	14	11	9	1	2	119	45	7.6	8.1
Other	10	29	15	12	1	5	5	12	13	9	6	6	1	124	42	7.1	7.5
Total No. of mentions	715	1868	783	667	59	302	461	746	741	611	470	181	36	7640	2965	....	....

*A —Motors, generators, and parts (manufacturing or repair).
B —Transformers, coils and related devices and parts.
C —Insulated wire and cable.
D —Wiring devices, connectors, etc.
E —Household and commercial appliances.
F —Switchgear, controls, relays, circuit breakers, switches, parts, etc.
G —Printed circuits.
H —Electronic components and parts (tubes, capacitors, resistors, semi-conductors, etc.).
I —Electronic and communication apparatus and assemblies.
J —Aircraft and missile parts and equipment.
K —Instruments and test equipment.
L —Electrically or electronically controlled, operated, or powered tools and machines.
M—Other.

Table 2—Solidified Material Improvements Desired

	Number	%
Total respondents using solidifying fluids	589	100.0
Users who did not answer question	64	10.9
Users suggesting one or more improvements	525	89.1

Solidified Material Feature or Factor Improvement Desired	Number of Mentions According to Product Code of User*													Actual Mentions			
	A	B	C	D	E	F	G	H	I	J	K	L	M	Grand Total	Actual Number	% of Users (589)	% of Replies (525)
Color	2	10	7	2	....	1	6	4	8	5	3	5	....	53	30	5.1	5.7
Adhesion and bonding	35	84	40	34	3	21	31	48	56	50	36	17	2	457	226	38.4	43.0
Abrasion resistance	16	15	23	10	1	6	11	13	15	20	10	5	....	145	73	12.4	13.9
Resilience and cushioning	14	38	11	12	1	8	15	20	22	17	13	5	....	176	81	13.8	15.4
Flexibility	32	51	25	17	3	11	18	24	25	26	18	7	2	262	131	22.2	24.9
Elongation	3	9	8	4	1	2	2	4	6	4	3	3	....	19	22	3.7	4.2
Toughness	27	38	28	12	2	7	10	21	20	20	13	7	1	206	112	19.0	21.3
Hardness	10	10	12	5	....	2	5	9	5	9	5	3	....	75	35	5.9	6.7
Tensile strength	10	21	10	7	2	3	9	8	11	15	8	4	....	108	50	8.5	9.5
Impact strength	8	25	13	9	2	5	13	12	21	14	9	7	1	112	60	10.2	11.4
Compressive strength	5	9	3	2	....	2	3	5	6	9	3	3	....	50	20	3.4	3.8
Light weight	3	30	8	10	....	4	16	14	31	23	12	3	1	155	61	10.3	11.6
Sealing	29	64	28	25	2	14	17	35	33	29	23	13	1	313	146	24.8	27.8
Moisture resistance	49	81	40	24	4	17	31	58	41	35	30	12	2	430	225	38.2	42.8
Chemical resistance	41	40	26	15	3	12	16	20	19	20	20	8	2	212	109	18.5	20.8
Compatibility with other insulations	32	57	32	15	5	16	21	25	31	33	21	8	3	299	141	24.0	26.9
Fungus resistance	16	23	12	6	2	4	10	10	13	12	13	9	....	130	60	10.2	11.4
Weather resistance	13	21	11	10	3	8	13	12	13	11	10	5	1	134	60	10.2	11.4
Thermal dimensional stability	21	56	24	16	3	9	26	35	41	41	26	10	1	309	151	25.6	28.8
Heat conductivity	20	43	12	8	2	8	17	26	27	22	15	8	....	208	104	17.7	19.8
Resistance to 105°C, 10 years	3	18	8	6	....	2	9	11	6	8	4	1	....	76	42	7.1	8.0
Resistance to 130°C, 10 years	8	22	8	5	....	2	7	10	11	8	2	1	....	84	46	7.8	8.8
Resistance to 155°C, 10 years	21	30	9	5	....	3	3	14	10	13	6	2	1	117	69	11.7	13.1
Resistance to 180°C, 10 years	22	36	11	7	....	7	7	20	12	13	7	1	....	113	86	14.6	16.4
Resistance to 220°C, 10 years	14	57	17	11	1	14	7	30	17	24	10	4	1	197	102	17.3	19.5
Resistance to 500°C, 1000 hrs.	11	36	26	14	3	10	8	27	19	38	16	5	1	211	101	17.1	19.3
Resistance over 500°C	9	23	21	10	1	8	7	21	20	34	19	2	....	181	88	14.9	16.8
Low temperature resistance	7	40	21	16	1	11	18	28	31	26	11	2	....	215	96	16.3	18.3
Radiation resistance	9	27	17	4	....	7	11	17	19	21	19	5	1	160	70	11.9	13.3
Corona resistance	14	56	17	10	2	9	13	26	25	14	16	6	1	209	108	18.3	20.6
Flame resistance	10	36	16	9	2	7	10	13	25	16	10	8	1	163	80	13.6	15.2
Dielectric strength	22	56	32	21	1	13	19	48	37	27	22	10	2	313	149	25.3	28.1
Insulation resistance	15	45	23	15	3	12	16	31	28	20	18	5	1	232	122	20.7	23.2
Dielectric constant	.....	30	11	8	1	3	15	25	30	16	14	3	....	156	73	12.4	13.9
Dielectric loss	1	22	9	7	1	1	12	24	20	13	14	3	....	130	65	11.0	12.4
Arc resistance & resistance to carbon tracking	27	45	16	12	2	12	10	25	19	14	15	12	1	210	120	20.4	22.9
Lower costs	24	70	19	11	3	11	16	22	9	16	18	5	1	231	140	23.8	26.7
Other	4	14	2	4	....	4	3	9	7	6	4	3	....	60	36	6.1	6.8
Total Number of mentions	607	1387	659	421	63	302	484	807	792	745	519	220	28	7034	3490	....	....

ments. The survey was very comprehensive—solidifying fluid processing equipment, applications, rating of producers, formulation by users, evaluation, etc. were some of the topics covered. Many of these survey topics will be reported on in future issues. In this issue you'll learn what readers think about the type of improvements needed in solidifying fluids.

Results

As previously mentioned, a total of 2,994 individuals, each at different plants, received the questionnaire. Tabulation of results started when a total of 893 questionnaires had been returned, a response of 29.83%. This is an exceptionally high response in view of the length of the questionnaire, time required to fill it out, and lack of any incentive other than a desire to cooperate.

Of the 893 questionnaires returned, 787 or 88.13% were considered usable. Of these 787 usable returns, 589 or 74.8 indicated that their plants used solidifying fluid insulations.

Solidifying Fluid Processing Improvements

Those who received the questionnaire were asked to indicate by means of a check mark those processing features or factors in which they would like to see improvements made for any of the solidifying fluid materials they used. More than two-dozen processing features or factors were listed. Of those who used solidifying fluids, 94.7% checked one or more improvements desired. This does not necessarily mean that the other 5.3% who did not check any improvements desired are completely happy since there are always some who will not answer all questions. Table 1 lists all of the processing features or factors which could have been checked for improvements. The number of mentions for each processing feature are listed according to the products made by the respondent's firm—in those cases where one respondent fell into more than one product group, the reply was counted under each product group. This type of breakdown helps to give some measure to variations of the importance of problems from group to group.

In table 1 the *actual* total number of mentions and percentages for each processing feature are also tabulated. As can be seen from the results, pot life is the most important processing feature needing improvement according to one out of every two users of solidifying fluids. It is followed closely by the curing or drying time. Next in importance is shrinkage during cure. Shelf life, curing temperature, bubbling, viscosity, toxicity, coatability, dispensing, exotherm, settling, deaerating, and other factors also show up as being of major concern to users. The relative rankings of these processing features requiring improvement should indicate to solidifying fluid producers the areas most needing attention.

Solidifying Material Improvements Desired

After asking solidifying users to indicate the processing features or factors in which they would like to see improvements made, they were asked to check the factors or features of any of the solidifying fluids they used which they felt needed improvement in respect to the materials *after* they had been processed and solidified. As shown in table 2, there were a considerable number of such factors or features listed. The fact that only 36 "other" mentions were checked and filled in by the respondents is indicative of the fact that this listing was quite complete.

The form for table 2 is similar to that of table 1. The number of mentions are listed for each product group of the respondents. In addition, the actual number of mentions for each feature are listed along with the percentages these mentions represent of the users and of those answering the question.

Adhesion and bonding properties headed the list of features requiring improvement with about two of every five replies checking this. Moisture resistance was a very close second. Another feature, sealing qualities, which might be considered somewhat similar to moisture resistance, also ranked very high as regards improvement desired. Thermal dimensional stability, dielectric strength, compatibility with other insulations, lower costs, flexibility, insulation resistance, arc resistance, toughness, chemical resistance, and corona resistance, all received a significant number of mentions.

Because so many features were listed, it is understandable that there would be some similarities and overlapping between various features in the minds of the respondents. For this reason, it is impossible to add together the number of mentions for various features to determine whether physical, electrical, or thermal properties were most important from the standpoint of requiring improvement. However, it is certainly of interest to note the number of mentions the various thermal properties received, such as thermal dimensional stability, heat conductivity, resistance to various temperatures for a ten year period, and low temperature resistance. Low temperature resistance as well as resistance to 220°C, 500°C, and over 500°C, all appear to be problems requiring solutions. With the exception of a few groups, interest in these various thermal features appears to be rather well distributed among various product manufacturers.

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*A —Motors, generators, and parts (manufacturing or repair).
B —Transformers, coils and related devices and parts.
C —Insulated wire and cable.
D —Wiring devices, connectors, etc.
E —Household and commercial appliances.
F —Switchgear, controls, relays, circuit breakers, switches, parts, etc.
G —Printed circuits.
H —Electronic components and parts (tubes, capacitors, resistors, semi-conductors, etc.).
I —Electronic and communication apparatus and assemblies.
J —Aircraft and missile parts and equipment.
K —Instruments and test equipment.
L —Electrically or electronically controlled, operated, or powered tools and machines.
M—Other.

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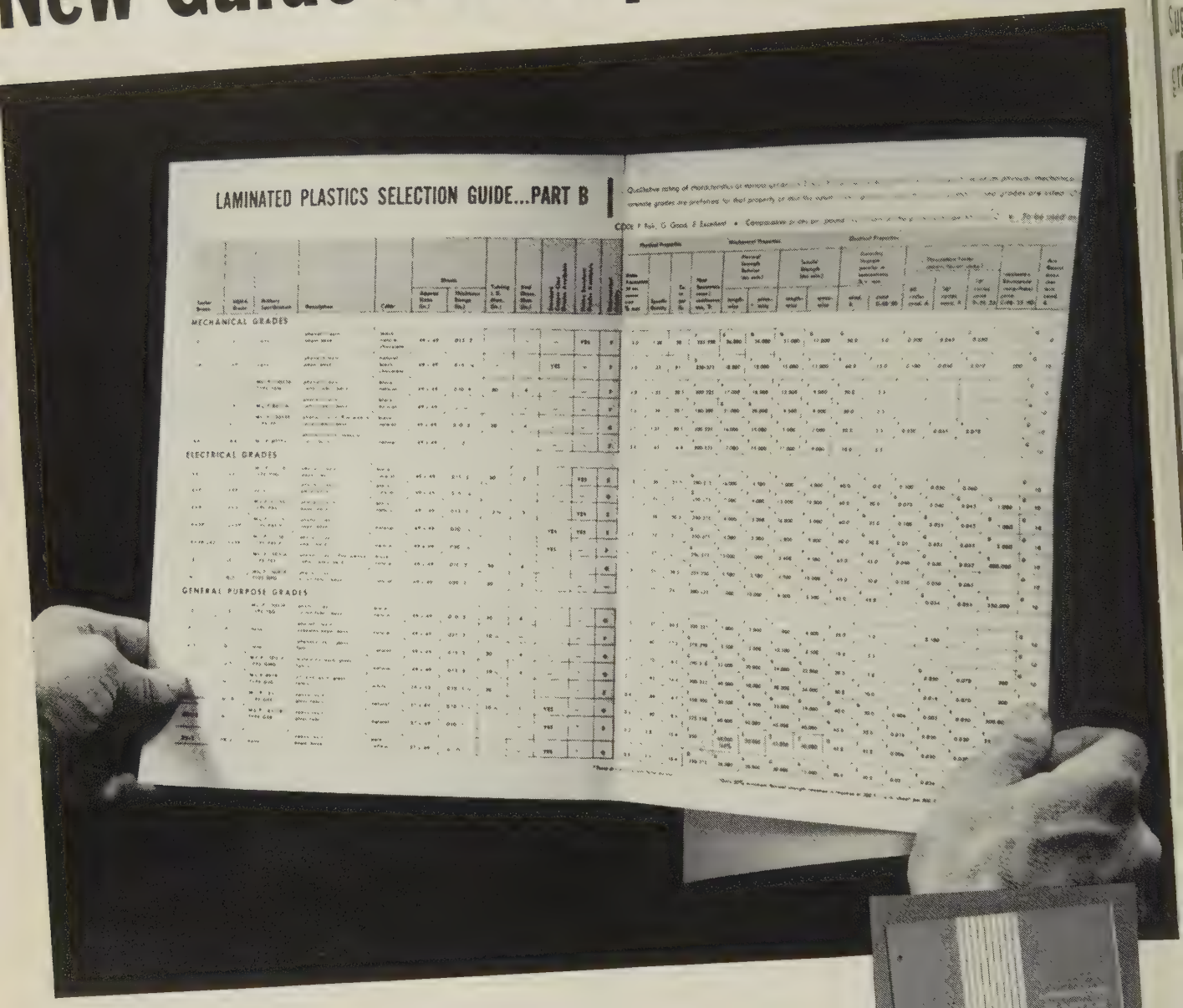

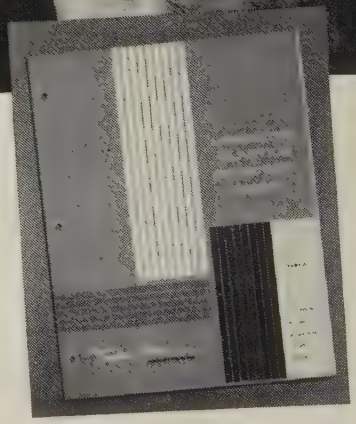

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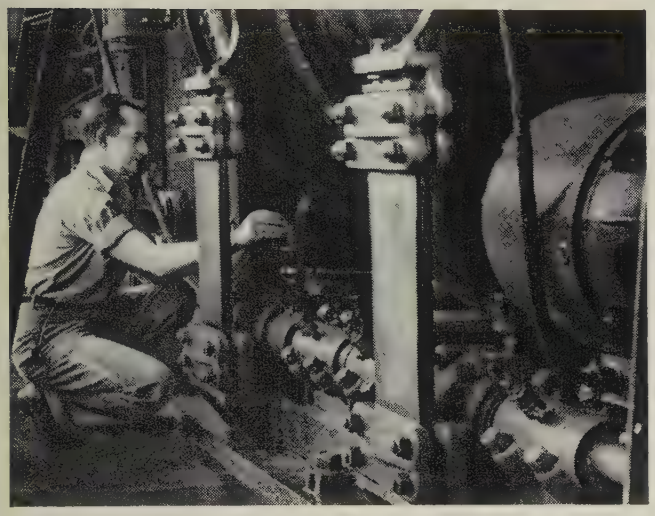
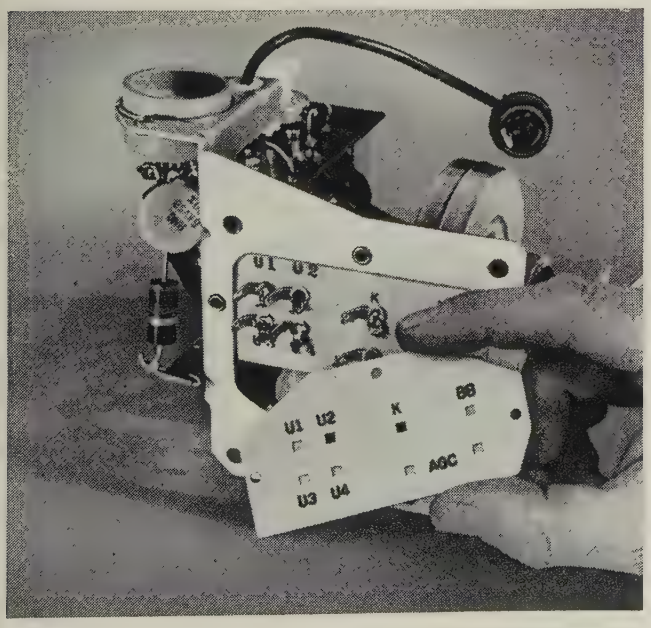
Simplifies Laminate Selection

Suggested applications of different grades of Taylor Laminated Plastics

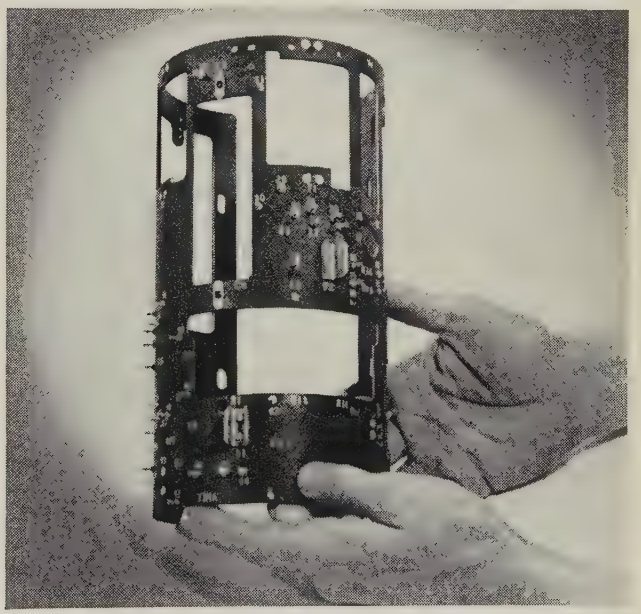


For the fabrication of springs, silent gears, pinions, cams and bearings: Taylor Grade C—a phenolic resin, cotton fabric base, mechanical grade and Taylor Grade L, a phenolic resin, fine weave cotton fabric base grade.



For high-temperature electrical applications and high-frequency radio equipment: Taylor Grade GSC—a silicone resin, glass fabric base, high-heat-resistant electro-mechanical grade.

For forming into intricate shapes, compound curves, and deep draws: Taylor Grade C-7—a phenolic resin, cotton fabric base, postforming grade. Also Taylor XX-7—a phenolic resin, paper-base postforming grade.



For applications requiring high-strength retention at elevated temperatures: Taylor Grade GEC—an epoxy resin, glass-fabric base grade.

Taylor

LAMINATED PLASTICS VULCANIZED FIBRE

NOMINAL WEIGHTS OF FINISHED WEATHER-RESISTANT WIRE AND CABLE

(Pounds per 1000 Feet)

Conductor Size AWG or Mcm	Copper & Copper Alloy Conductors: URC Type Double Braid	URC Type Triple Braid	Neoprene Type	Polyethylene Type	Aluminum Conductors: Neoprene Type	Polyethylene Type
Stranded						
2	246	270	248	230	105	87.4
4	155	170	163	143	73.3	53.3
6	103	115	108	91.5	51.5	35.0
Solid						
2	239	260	232	219	92.2	79.2
4	151	164	152	136	64.0	48.0
6	100	112	101	87	45.7	31.7

Sources: American Standards Association Specifications

This table shows

POLYETHYLENE covered line wire weighs less

Because it's the lightest, polyethylene-covered line wire is the easiest for linemen to string up . . . hardest for ice and snow loading, gale-force winds to bring down.

Polyethylene-covered line wire, depending on size and conductor, weighs from 5% to 32% less than other types. That's what the figures in the specifications tabulated above show.

This, of course, is no news to linemen who have strung all types of weatherproof line wire. They may not be able to quote pounds and percentages, but they all know you can't beat polyethylene on weight.

Linemen's Favorite Material

Light weight means easy handling, one of the main reasons polyethylene rates tops with installation crews. They also like polyethylene wire because it's clean . . . free-stripping . . . has a smooth, self-lubricating surface that almost makes pulling a pleasure. And despite the exterior slip, the plastic covering hugs the conductor tightly, doesn't ruffle as it goes over crossarms.

"Built-in" Safety Factor

Polyethylene's lightness provides lasting mechanical advantages, since span loads don't tax supports as much as heavier type wire. This "built-in" weight safety factor pays off when violent storms push aerial construction to strain limits . . . when ice and snow loads topple heavier lines.

An added factor in polyethylene wire's ability to stay up under adverse conditions is its smaller diameter. It offers less resistance to wind, a smaller surface for ice build-up.

Winning Combination

Called the "closest to the ideal covering for line wire," polyethylene is outstanding in other respects too. The shield it forms over wire is continuous . . . tough . . . resistant to aging, weathering, moisture, abrasion by lashing branches. It's good for decades of superior service marked by fewer outages, minimum maintenance.

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Electric Insulation Program for May 1-5 Electrochemical Meeting

A three-day symposium on electrolytic capacitors, as well as a general session on electric insulation, will be held at the Electrochemical Society meeting in Chicago, May 1-5. The convention headquarters is the La Salle Hotel. Registration fee is $7 for members and $13 for nonmembers.

All registrants are invited to attend the Monday evening mixer in the Illinois Room from 8 to 10 p.m. Complimentary beer, soft drinks, and snacks will be served.

On Tuesday, Bill Veeck, president of the American League champion Chicago White Sox baseball club, will be the guest speaker at the society luncheon and business meeting which begins at 12:15 in the Illinois Room. Professor A. N. Frumkin, Director of the Electrochemical Institute of the USSR, will deliver the Palladium Medal Address at 5 p.m. in the Illinois Room. A reception honoring President and Mrs. W. C. Gardiner will be held at 6:30 p.m. in the Grand Ballroom. Cocktails will be served from 6:30 to 7:30 p.m. Dinner begins at 7:30 p.m.

On Wednesday, the Electric Insulation Division luncheon and business meeting will begin at 12:30 p.m. in the La Salle Room. Arrangements with the Chez Paree night club for that evening include a cocktail hour, dinner, and entertainment. Red Skelton will be featured. Tickets will be available at the registration desk for $10 each.

The following is a complete program of the scheduled insulation sessions.

Electrical Insulation Technical Program

Monday, May 2

Electrolytic Capacitors—C. C. Houtz, Bell Telephone Laboratories Inc., presiding; Parlor D, Mezzanine.

9:00 a.m.—Introductory remarks by A. J. Sherburne, General Electric Co.

9:15 a.m.—Electrolytic Oxide Films, by J. Burnham.

10:10—Conduction, Storage, and Photoelectric Phenomena in Anodic Aluminum Oxide Films, by Kurt Lehovec, Sprague Electric Co.

11:05 a.m.—Impedance Characteristics of Anodic Oxides, by L. Young, British Columbia Research Council, University of British Columbia.

Continuation of morning session with R. A. Ruscetta, General Electric Co., presiding.

2:00 p.m.—Tantalum Anode Reactions, by Donald Stephenson and Robert Russ, Transitor Electronics Inc.

2:30 p.m.—Dielectric Characteristics of Tantalum Anodic Oxide Films as Related to Film Structure, by D. Mohler, General Electric Co.

3.00 p.m.—Hydrated Oxide Films on Aluminum, by Dietrich Altenpohl, Aluminum-Walzwerke Singen, Singen/Hohentwiel, West Germany.

3:30 p.m.—Anodic Formation of Aluminum Oxide Films, I. The Influence of Surface Preparation on Film Properties, by W. E. Tragert and J. R. Rairden, General Electric Co.

4:00 p.m.—Anodic Formation of Aluminum Oxide Films, II. Effect of Various Electrical Forming Conditions on Film Properties, by W. E. Tragert and J. R. Rairden, General Electric Co.

4:30 p.m.—Determination of the Thickness of Thin Porous Oxide Films on Aluminum, by M. S. Hunter and P. F. Towner, Aluminum Co. of America.

Tuesday, May 3

Electrolytic Capacitors (cont'd)—C. C. Houtz presiding, Parlor D, Mezzanine.

9:00 a.m.—Capacitor Grade Tantalum, by L. H. Belz, Kawecki Chemical Co.

9:30 a.m.—Measurement of the Specific Surface Area of Tantalum Powders and Sintered Anodes, by W. G. Guldner and C. C. Houtz, Bell Telephone Laboratories Inc.

10:00 a.m.—Some Physical Properties of Metallic Tantalum, by J. I. Budnick, International Business Machines Corp.

10:30 a.m.—Low-Temperature Sintering of Tantalum Anodes, by C. J. B. Fincham and G. J. Villani, National Research Corp.

11:00 a.m.—Determination of the Thickness of Anodic Oxide Films by the Spectrophotometric Method in Conjunction with the Abelès Method for the Refractive Index, by L. Young and J. E. Orme, British Columbia Research Council, University of British Columbia.

11:30 a.m.—Electrolytic Etching of Dense Tantalum, by A. L. Jenny and R. A. Ruscetta, General Electric Co.

12:15 p.m.—Society Luncheon and Business Meeting, Illinois Room. Bill Veeck, president of the Chicago White Sox, guest speaker.

Continued next page

Continuation of morning session with R. A. Ruscetta presiding.

2:00 p.m.—Niobium (Columbium) Solid Electrolytic Capacitors, by N. Schwartz, M. Gresh, and S. Karlik, Bell Telephone Laboratories Inc.

2:30 p.m.—Columbium (Niobium) Electrolytic Capacitors, by A. Shtasel and H. T. Knight, Fansteel Metallurgical Corp.

3:00 p.m.—Silicon Nitride Thin Film Dielectric, by C. R. Barnes and C. R. Geesner, Wright Air Development Center.

3:30 p.m.—Properties of Anodically Formed Oxide Films on Tungsten, by H. W. Pitman and D. C. Hamby, Linfield Research Institute.

4:00 p.m.—Ion Size Effect and Mechanism of Electrolytic Rectification, by P. F. Schmidt, Westinghouse Research Laboratories, and F. Huber and R. F. Schwarz, Philco Corp.

5:00 p.m.—Palladium Medal Address, A. N. Frumkin, Illinois Room.

Wednesday, May 4

Electrolytic Capacitors (cont'd)—L. Young presiding; Parlor D, Mezzanine.

9:00 a.m.—The A-C Properties of Tantalum Solid Electrolytic Capacitors, by D. A. McLean, Bell Telephone Laboratories Inc.

9:30 a.m.—A Mathematical Model for the Porous Type Tantalum Anode Capacitor, by J. S. Fisher, Bell Telephone Laboratories Inc.

10:00 a.m.—Cathodic Depolarization in Tantalum Electrolytic Capacitors, by T. C. O'Nan, P. R. Mallory & Co. Inc.

10:30 a.m.—Cell and Thermoelectric Effects of Tantalum Electrolytic Capacitors, by J. M. Law and W. C. Richards, Fansteel Metallurgical Corp.

11:00 a.m.—A Selective Electrochemical Etching Procedure to Improve D-C Characteristics of Oxide Film Capacitors, by R. W. Berry, N. Schwartz, and M. Gresh, Bell Telephone Laboratories Inc; and M. J. Urban, Daystrom Inc.

12:30 p.m.—Electric Insulation Division Luncheon and Business Meeting, La Salle Room. A. J. Sherburne will speak on "Electrical Insulation in Retrospect."

Continuation of morning session with J. Burnham presiding.

2:00 p.m.—Equivalent Series Resistance of Anodically Formed Oxide Films on Aluminum, by W. J. Bernard, Sprague Electric Co.

2:30 p.m.—Factors Determining Allowable Ripple Current at Various Frequencies in Aluminum Electrolytic Capacitors, by R. Lane and A. Bennett, Pyramid Electric Co.

3:00 p.m.—500°C Capacitors, by R. J. Stamets and R. A. West, General Electric Co.

3:30 p.m.—A Novel Low Voltage Electrolytic Capacitor Without Conventional Spacers, by A. J. Catotti and R. A. West, General Electric Co.

4:00 p.m.—Volume Resistivity of Ammonium Ethylene Glycoborate Electrolytes, by C. C. Houtz, Bell Telephone Laboratories Inc.

Thursday, May 5

Electric Insulation General Session—A. H. Sharbaugh, General Electric Co., presiding; Parlor D, Mezzanine.

9:00 a.m.—Electrical Properties of Some Aliphatic Acids and Alcohols, by A. M. Parks, International Business Machines Corp.

9:30 a.m.—Effects of Tropical Exposure on the Electrical Properties of Insulating Materials, by L. J. Frisco, The Johns Hopkins University.

10:00 a.m.—Effect of Heat on the Electrical Properties of Paper, by L. H. Wirtz and T. D. Callinan, International Business Machines Corp.

10:30 a.m.—The Electric Strength of Insulating Liquids, by A. H. Sharbaugh, General Electric Co.

11:15 a.m.—Dielectric Properties of Very Thin Films of Liquid Dielectrics, by T. Salomon, Institut Francais du Petrole, Paris, France.

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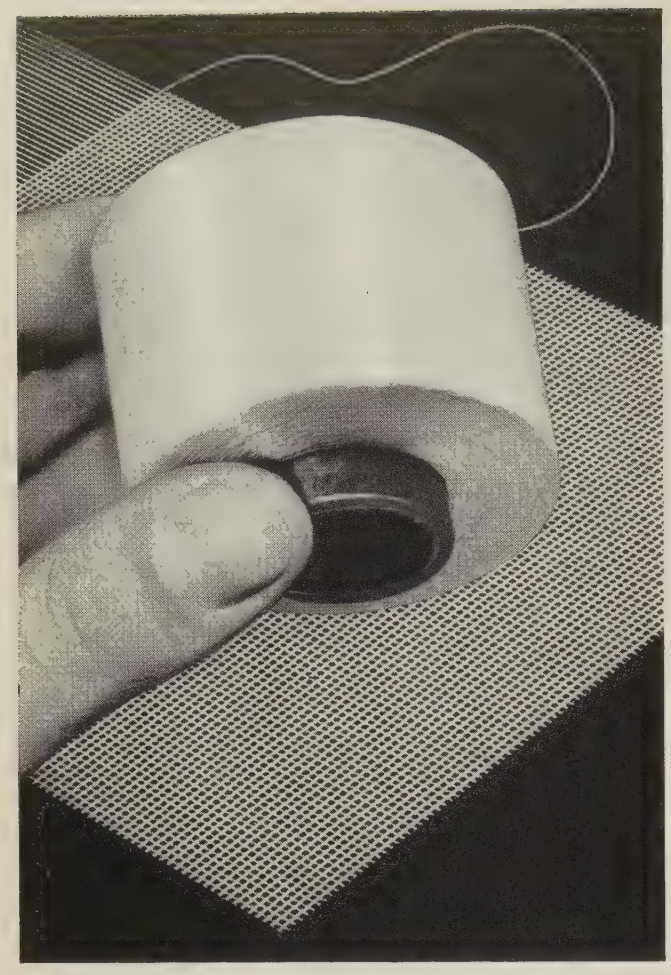

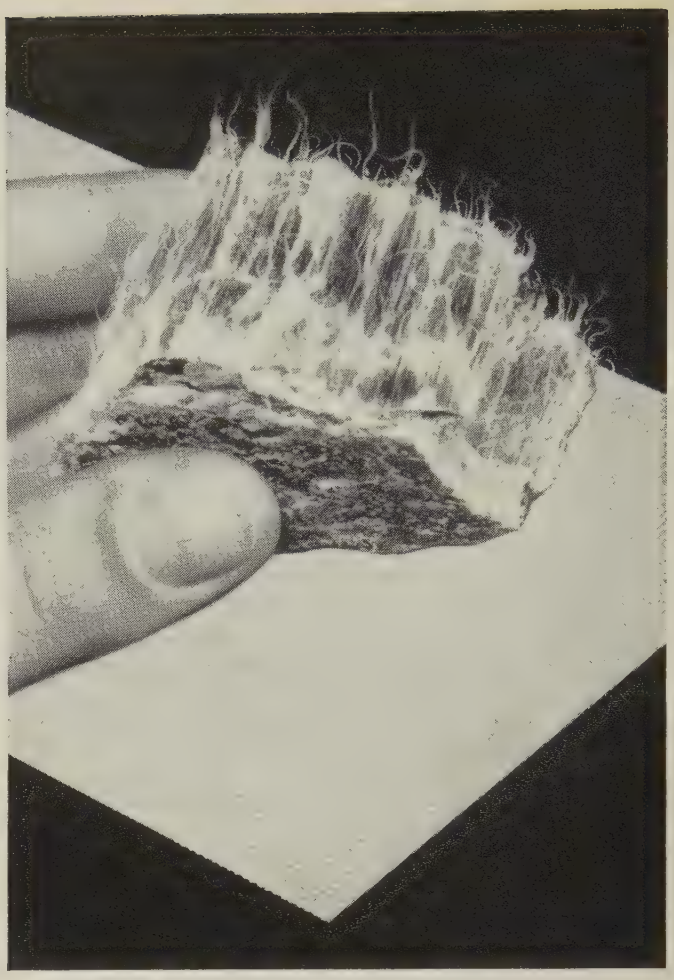

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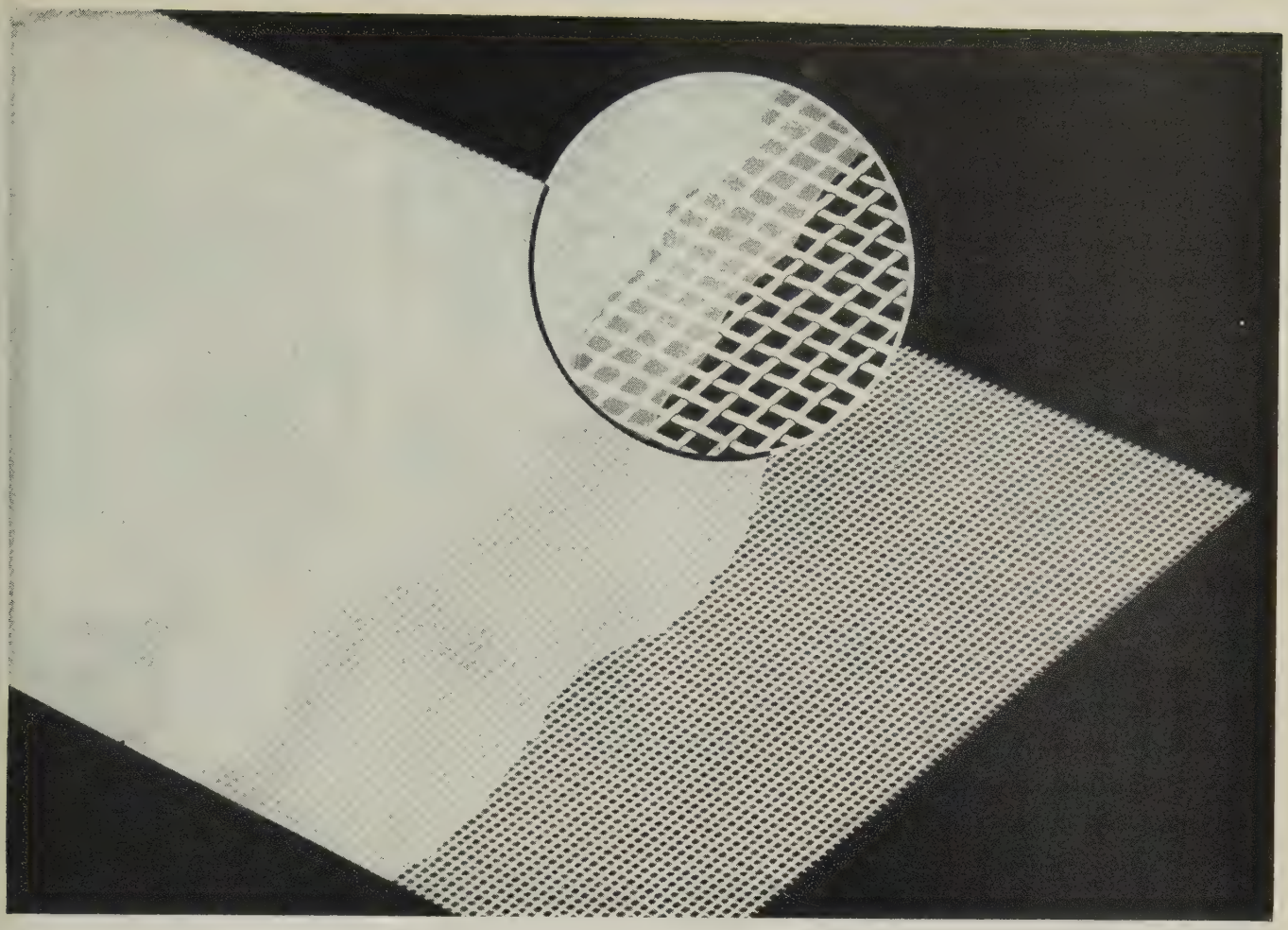

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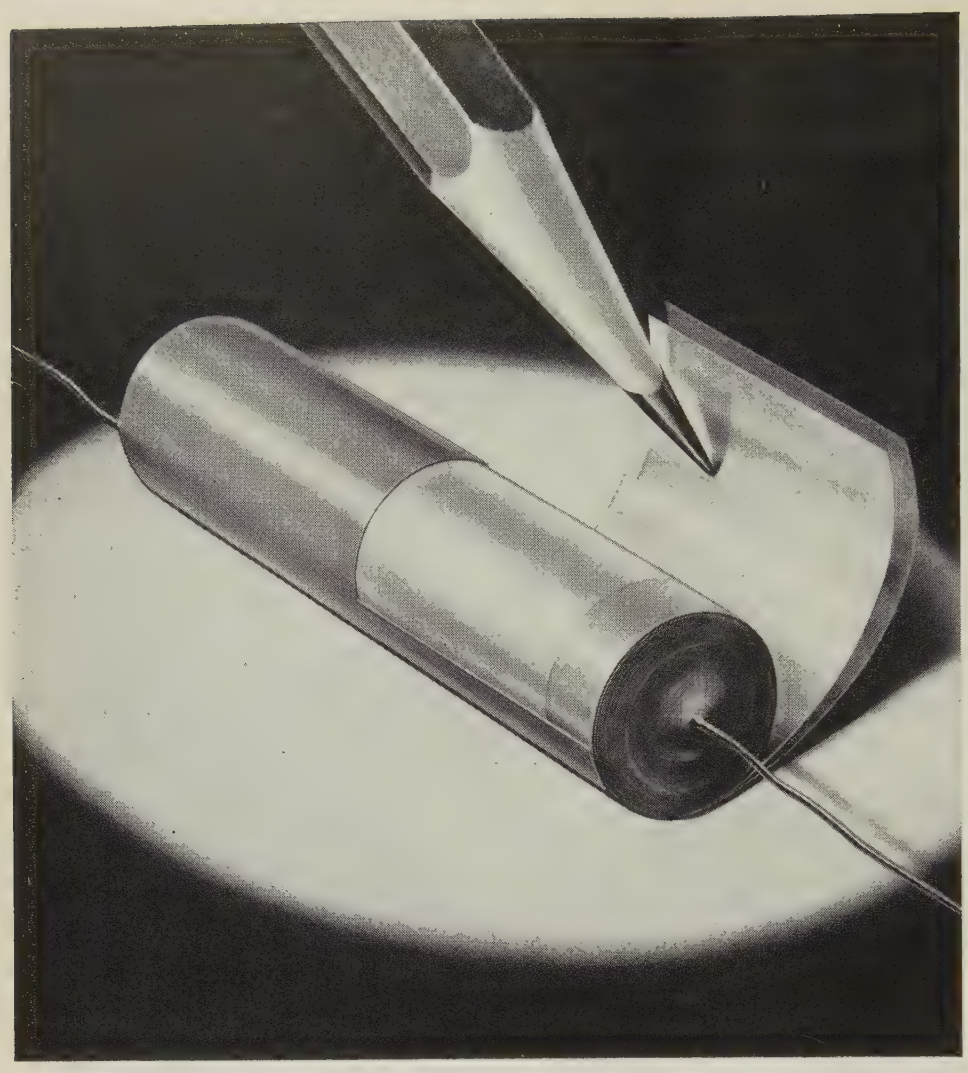

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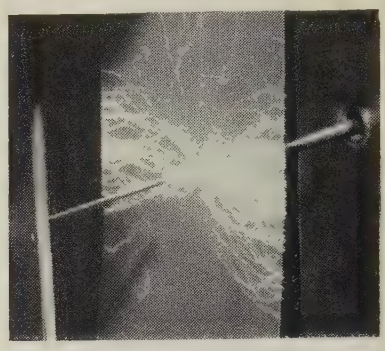

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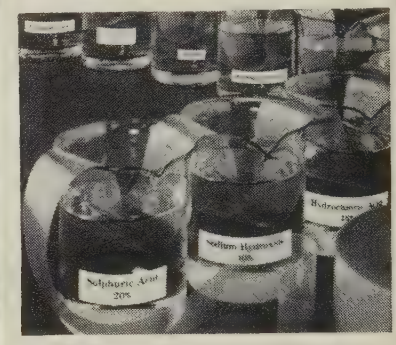

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Rubber-Phenolic Adhesive Bonds 475 Tons Of Silicon Steel In Electron Accelerator

P. D. Peltier and R. T. Firrera

By Pierre D. Peltier, Staff Industrial Engineer, Baldwin-Lima-Hamilton Corp., Eddystone, Pa., and Richard T. Firrera, Technical Service Representative, Rubber and Asbestos Corp., Bloomfield, N.J.

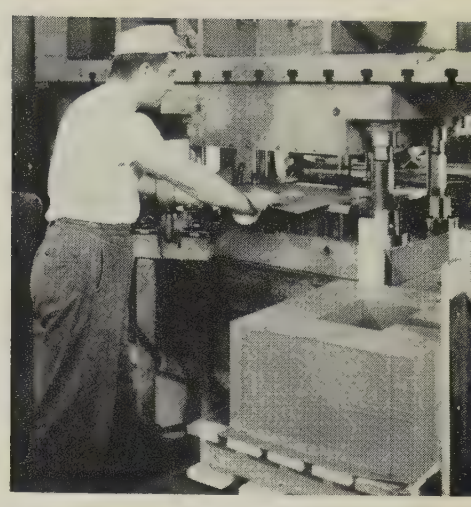


Figure 1, precision one-two punch by 450-ton hydraulic press forms pole faces on magnet cores for accelerator. First punch cuts stress-relieving keyhole to prevent thin steel sheet from curling; second punch cuts finished pole face and central rectangular opening. Laminations are handled one at a time.

In a special process developed by the Eddystone Division of Baldwin-Lima-Hamilton Corp., magnet cores are built up from 420,000 laminations of silicon steel sheets, each one less than 0.015-inch thick, bonded together with a specially developed rubber-phenolic adhesive.

There are 612 of these cores which go into the 6-billion electron volt Cambridge Electron Accelerator, a research machine now under construction at Harvard University for keeping electrons in orbit as they are accelerated around a quarter-mile track at velocities approaching the speed of light.

While the "chemical fastening" of steel laminations without mechanical connections of any kind to produce magnet cores is a widely used technique, the utilization of 475 tons of steel in one bonding application can well be said to make this an extremely unusual production problem. Beyond that, however, the use of a solvent-dispersed adhesive in place of the conventional epoxies makes this process truly unique. The technique had to be developed from scratch.

Before starting full-scale production, 24 huge prototypes were built and shipped to Cambridge for testing. When all cores met the design specification, Harvard authorized Eddystone to start production. Today, cores are being turned out at the rate of 30 per week in a block-long, hospital-clean wing of an Eddystone shop.

So critical were the specifications applying to these magnetic cores that, even before the start of assembly, a full-scale sorting and gigantic "shuffling" operation was carried out on all the steel sheets which went into the cores. While all the laminations were made from the same grade of steel, the enormous quantity involved had to be produced at the mills in several heats. This, in turn, led to the possibility that the different heats might impart variations in the magnetic properties of the steel. The shuffling process was required to insure that each core was magnetically identical with every other core in the accelerator. Thus, all of the steel for the core-building job had to be on hand before the shuffling could begin—a job of considerable magnitude.

Actual production of the magnetic cores involves an extremely exacting eight-step process:

1) Pole tips are formed by a 450-ton press equipped with a special carbide die. Each silicon steel sheet is handled separately in a two-step punching operation with half being blanked with an open throat and half with a closed throat at the pole tips. Since the stream of electrons will pass through these openings, the width of the pole tip gaps is held to within 0.002-inch to insure that the electrons will follow their prescribed orbit exactly.

2) All foreign matter is removed from the metal in a chemical degreasing tank equipped with an Eddystone-designed and built automatic timing device and electrical transfer mechanism to insure uniform chemical treatment of the metal. Once degreased, each steel sheet is henceforth handled with surgical gloves until after the bonded cores have been cured by baking in a gas-fired oven near the end of the production process. The gloves are worn because the natural body oils, normally present on hands, would destroy the perfect bond needed between the adhesive and steel to insure that cores will perform according to specifications.

3) The next step involves the application of the specially formulated rub-

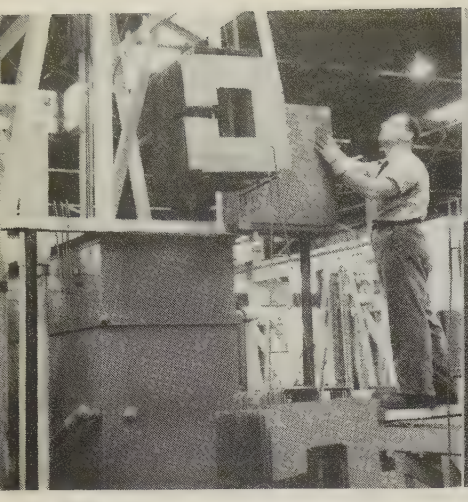


Figure 2, degreaser insures chemically clean metal prior to coating of laminations with adhesive. Degreasing unit uses Eddystone-designed and built timing and transfer device. It can clean about 300 laminations per hour.

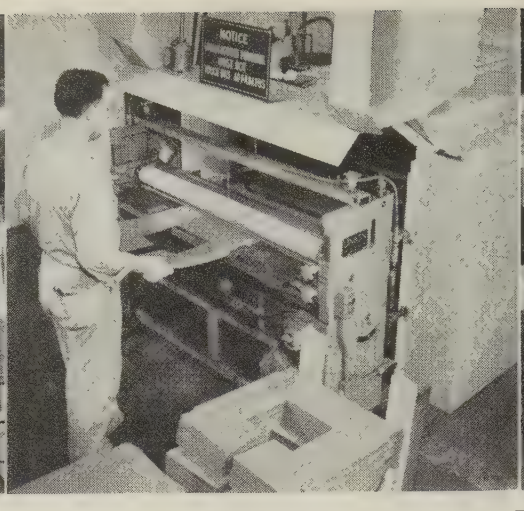


Figure 3, coating machine applies thin, uniform film of rubber-base phenolic adhesive to both sides of each chemically clean lamination. Coated lamination is picked up by automatically timed conveyor and carried through precuring ovens heated by infrared lamps. Volatile solvent is exhausted by fans and discharged through vents in roof. Operator changes gloves frequently.

Figure 4, precured adhesive-coated laminations emerge from oven conveyor and are stacked on a special fixture which insures their alignment. The sheets must be stacked so that the 10.5-inch thick cores will be in true alignment across the pole faces within 0.001-inch.

ber-phenolic solvent-dispersed adhesive (Bondmaster E379, developed by Rubber & Asbestos Corp., Bloomfield, N.J.). When fully cured, stacks bonded with this strong, flexible, solvent-resistant adhesive feature an excellent combination of shear strength (over 1,000 psi), peel strength (over 20 pounds per inch), as well as good tensile strength, impact strength, and fatigue strength. When tested under a bombardment of gamma rays of 10^9 Roentgens at a rate of 7×10^5 per hour, the formulation retains 83% of its initial strength.

The viscosity and rate of solvent evaporation were worked out in cooperation with the adhesive manufacturer to provide for maximum mass production efficiency in this stage of production. Not only must extreme care be taken in handling to prevent bending or twisting the laminations out of shape during the coating, but carefully metered amounts of adhesive must be automatically and continuously applied to both sides of each lamination without deviation from sheet to sheet.

4) Then, the adhesive-coated pieces are precured in a 90-foot-long conveyor-fed oven which moves the steel under infrared lamps at a speed of up to 25 feet per minute.

5) Precured laminations are stacked on a special fixture which insures perfect alignment within 0.001-inch across the 10.5-inch thickness of each core, since greater variation in alignment would cause electrons to be lost before they could be brought to their full energy in the completed accelerator.

6) Final curing of the adhesive is done in an automatically controlled oven. The bonded cores move on a roller conveyor in groups of three into the large walk-in oven where they are baked at approximately 400°F for several hours. Thermocouples attached to the cores indicate the temperature on instruments outside the oven which automatically shut off the heat upon completion of the curing cycle.

7) Cleaning excess adhesive from pole tips and reference surfaces is a painstaking hand operation, done by carefully applying the cleaning compound in delicate strokes with a small brush.

8) Inspection of completed cores requires accurate measurements of dimensions, checking of weights to determine the lamination factor, and delicate electrical measurements to check the electromagnetic properties of the core. The lamination factor is the ratio of the finished core to the weight of a solid piece of steel having the same cubic dimensions. The Cambridge cores are permitted a lamination factor of 92 to 93 percent—in other words, although made of thin laminations bonded together with adhesive, the cores approach being solid steel. The electrical measurements confirm that all laminations are insulated from each other by the rubber-based adhesive.

Eddystone has also been awarded new contracts to supply magnet cores for additional research synchrotrons that will be built in the near future at Princeton University. These electron accelerators involve a new principle of electromagnetism discovered less than five years ago. Its use permits smaller and cheaper devices for accelerating subatomic particles, making it economically feasible to construct synchrotrons with the high energy levels necessary to unfold the secrets of the interior of the atom. The use of the principle, however, requires extreme accuracy in the construction of the cores for the strong focusing magnets.

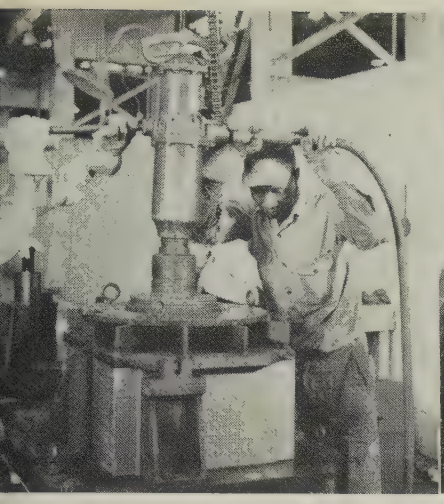


Figure 5, impact wrench is used to tighten fixture holding laminated core. The wrench, too big to be hand held, is lifted into place with small overhead hoist. Pressure applied to adhesive-coated laminations by wrench tightening of face plate nut insures uniform thickness of finished core.

Figure 6, gas fired oven, with external automatic controls actuated by thermocouples attached to cores, bakes adhesive-coated cores for several hours at 400°F to cure the rubber-based adhesive that holds the laminations together. When cores reach preset temperature, control instruments will turn off the heat. Operator is shown attaching thermocouples to cores.

Figure 7, artist's touch is needed to perform delicate job of cleaning excess adhesive from pole tips and reference surfaces of bonded and heat-cured core. After considerable experimentation with other methods and costly industrial chemicals, engineers discovered that best cleaning method was to brush on a water soluble paint remover found on the shelf of a local hardware store.

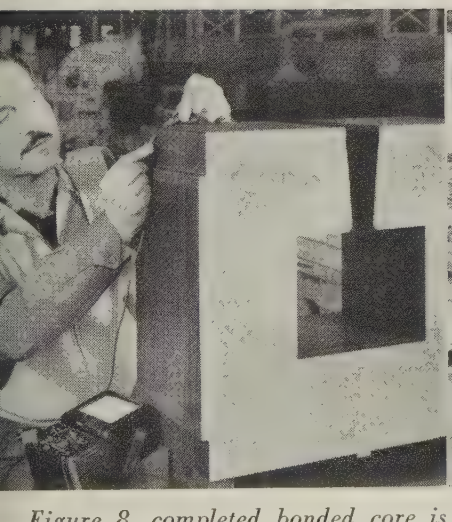


Figure 8, completed bonded core is checked with sensitive ohmmeter to be sure that all laminations are electrically insulated by the bonding adhesive.

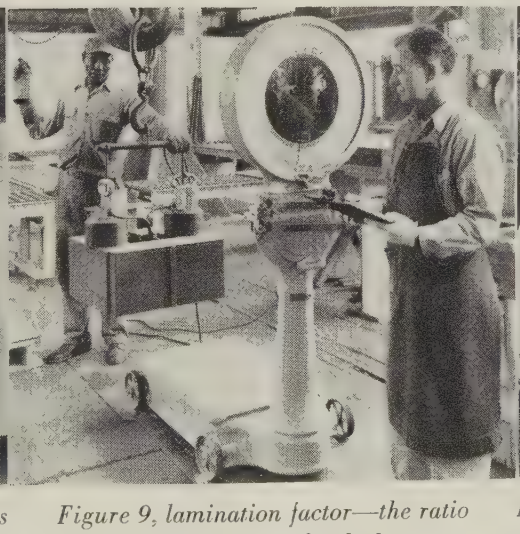


Figure 9, lamination factor—the ratio of the weight of the finished core to the weight of a solid piece of steel of the same cubic volume—is an important indicator of the future performance of the core. It is checked here on scale. A lamination factor of 92 to 93 percent is permissible. Magnetic hoist is used to lift the cores because ropes, chains, or slings might cause slight burrs that would ruin the completed core.

Figure 10, inspection of completed core is made by Charles Stewart, Eddystone inspector, with sensitive ohmmeter and with precision gauges to check dimensions and alignment, and to be sure that all laminations are electrically insulated from each other by the bonding adhesive. P. D. Peltier, center, project engineer who developed the process for making the cores, and Fritz Henn, production supervisor, look on.

Pixilated Patents

By Mike Rivise

(Forty-first in a series of odd and interesting inventions in the electronics field from the files of the U.S. Patent Office.)

Patent No. 822,175 granted to Edson R. Wolcott on May 29, 1906, concerned a process of locating and also extracting metals from beneath the earth's surface by means of electricity. The process consisted of placing electrodes in the ground at a suitable distance from each other, moistening the earth between the electrodes, if necessary saturating the earth with acids adapted to dissolve the metals contained in the earth, and finally, passing a current of electricity from the anode to the cathode. According to the patent description, "In this event the dissolved metals will be carried along with the electrical current and deposited at or upon the cathode."

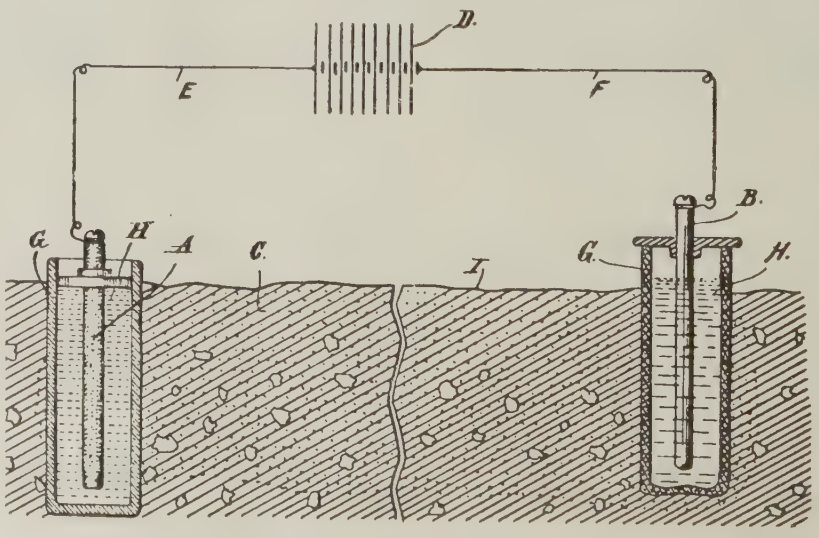
In the drawing, A and B designate the anode and cathode; C, the earth containing the metals to be located and extracted; D, a source of electricity; E and F, conductors leading from the pole of the source of electricity to the anode and cathode, respectively. The electrodes are preferably inserted in porous jars G, containing an electrolyte H. The surface of the earth is indicated by the line I.

The principles of the operation of the method are said to be as follows: "When an electric current flows between two electrodes embedded in moist earth, as between A and B, such metallic ions as are in solution adjacent to the electrodes act as carriers of the electricity and are deposited on the cathode according to the laws of electrolysis after having been forced through the earth according to the principles of electrical endosmosis. The earth here acts as the porous body and the solution is forced through it in a manner similar to the way in which solution is forced through capillary tubes or a porous jar by an electrical current. In case there are present bodies of metal or their ores not in solution, by pouring a suitable solution upon the surface it diffuses and eventually dissolves the metals or ores and ions formed.

"By changing the position of the electrodes and noting the relation between the quantity of electricity used and the quantity of the deposit formed the location of the body of metal or ore can be determined—that is, when the body of metal or ore is exactly between the electrodes a smaller quantity of electricity suffices to produce the same quantity of the metallic deposit, since when the body of metals or ores is at a greater distance from the electrodes a smaller number of the metallic ions would act as carriers, and hence a greater quantity of electricity would be required to flow before the same quantity of the metallic deposit would be formed.

"The porous jar G preferably surrounds the cathode to prevent direct contact between it and the earth, as some of the deposit might thereby be lost. Under certain conditions the deposit does not adhere firmly to the cathode, and when the latter is placed in a porous jar the vessel retains all deposit that may be precipitated from the solution or that may fall from the cathode. Such a jar may be made from unglazed porcelain.

"The same invention could be used at great depths by running insulated wire to such depths and attaching proper electrodes to the same. The anode should consist, preferably, of a non-decomposable conductor — namely carbon — while platinum answers the purpose of a cathode where quantitative results are desired, although numerous less expensive metals could be used at other times."



BAKELITE BRAND High-Density Polyethylene DGD-4100

HERE IS A HIGH-DENSITY POLYETHYLENE that has superior insulating and jacketing properties offering outstanding advantages for telephone singles and for jacketing in many communications applications.

BAKELITE Brand high-density polyethylene DGD-4100 shows superior resistance to environmental and thermal stress cracking. It also has greater resistance to deformation at high temperatures. Both these properties are important for insulation on telephone cable singles. As a jacketing material DGD-4100 will withstand considerable physical abuse. For example, it survived 1.5 million cycles in standard IPCEA tree wire tests—50% better than other high-density polyethylenes tested! It meets REA specifications for rural C wire and military specification MIL-C-55036 for telephone singles.

And along with these properties, it shows improved toughness and shear strength without sacrifice of such familiar polyethylene advantages as light weight, weather resistance, excellent insulating properties, and ease of handling.

Wire and cable insulated or jacketed with high-density polyethylene DGD-4100 can mean maximum reliability of transmission systems. For additional information and samples, write Dept. AK-75, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Union Carbide Canada Limited, Toronto 7.

TYPICAL PROPERTIES "BAKELITE" DGD-4100 BLACK 9845

Properties	ASTM Test	Typical Value
Melt Index @ 44 psi (gms/10 min)	D 1238	0.2
Density	D 1505	0.957
Tensile Strength, psi	D 412	3400
Per Cent Elongation	D 412	250
Durometer Hardness, Shore Type "D"	D 676	58
Brittleness Temp., °C.	D 746	-95
Shear Strength, psi	D 732	3000
Stiffness in Torsion, @ 23°C., psi	D 1043	100,000
Tree Wire Abrasion Test	(1)	
50% Abraded (Cycles)		800,000 ca.
100% Abraded (Cycles)		1,500,000 ca.
Environmental Stress Cracking, F_{50}, hrs.	D 1693 (2)	500
Thermal Embrittlement Resistance, hrs. @ 70° C., F_0	(3)	5000
Deformation at 110 deg. C., per cent	(4)	0
Dielectric Constant	D 1531	2.65
Dissipation Factor	D 1531	.004
Dielectric Strength, Short Time, volts/mil	D 149	580

(1) IPCEA Tree Wire Test—S1981
(2) Samples previously aged 7 days @ 70° C.
(3) Standard U/L Heat Shock Test—1/32" insulation on #14 AWG solid copper conductor wrapped around its own diameter.
(4) UCPC Method WC 75 B/3—1/32" wall on #14 AWG wire. Test terminated at 5000 hrs.

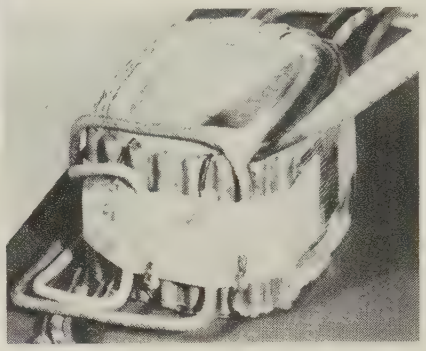
UNION CARBIDE

"Bakelite" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

Print Ins. 26 on Reader Service Card

Corrugated Insulation Speeds Core Wrapping

Corrugated vulcanized fibre provides good insulating properties and forms guide channels to protect lead wires and connections when used as an outer wrapping on core windings of a small transformer. On this unit (photo), leads from the winding taps



connect with external wiring. These connections are then pressed into the corrugations and wrapped with tape. This method firmly secures the connections, preventing movement and accidental contact. It is said to be faster than use of flat fish paper too, because the channels hold the wires in place during wrapping.

The corrugated material used is "Peerless" insulation grade vulcanized fibre made by National Vulcanized Fibre Co.

New Cryogenics Lab And Gyroscope

A new cryogenics laboratory and progress toward a super-accurate inertial guidance device (gyroscope) has been announced by General Electric Co. The company said it has successfully suspended a small metal body in a vacuum and has rotated it at high speed essentially without friction—made possible in part by "complete absence of measurable electrical losses." The new laboratory, said to be the nation's latest facility exclusively for application work in cryogenics, will complement investigative work by the G. E. Research Laboratory which 10 years ago opened the nation's first industrial laboratory devoted wholly to research in cryogenics.

Cable Spacer System

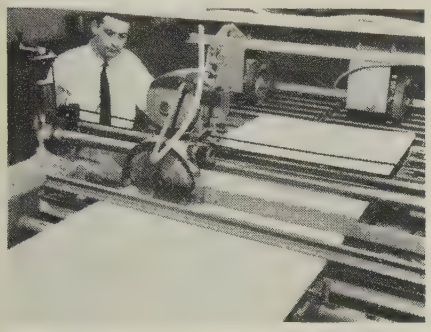
One of the newest aerial cable spacer systems features a simply designed spacer, a new high-strength aluminum messenger, and insulated phase conductors specially constructed for use with spacers. The entire system, installed, is reported to cost less than preassembled aerial cable and only slightly more than standard open wire. The spacer, designed for sys-

tems operating at 5 to 15 kv, is a compact, high strength, one-piece "Plexiglas" unit with neoprene grommets. The grommets, slotted to slip around the cable, snap into the spacer's guide paths. There are no movable or removable parts in the spacer which holds the cables six inches apart. The ⅜-inch aluminum messenger, composed of seven strands, has two strands of EC grade conductor and five strands of "Alumoweld." It was designed to combine high strength with low resistance. Other types of messengers are also available for use with the spacer system. Phase conductors are of hard-drawn EC grade aluminum with a minimum conductivity of 62 percent IACS. Both polyethylene and butyl rubber insulations are available with neoprene jacketing. Kaiser Aluminum & Chemical Sales Inc., Oakland, Cal.

Polyethylene for Radiation Shields

Polyethylene radiation shields, so thick (over 1 inch) they must be cut by specially designed saws, are being produced for use on atomic powered vessels by Panelyte Div., St. Regis Paper Co., Richmond, Ind.

The polyethylene panels reportedly provide excellent protection from neutron bombardment and weigh much less than conventional materials such as concrete and lead. The hydrogen nuclei in the polyethylene reduce the energy in the high energy neutrons created by atomic fission. Boron, a small quantity (1 or 2 percent) of which is compounded with the polyethylene, absorbs the remaining low energy neutrons. "Petrothene" 100, a polyethylene resin supplied by U. S. Industrial Chemicals Co., is used to make the panels. The panels have extremely high surface smoothness and gloss, and uniform thickness, factors which are important for the installation of panels where many thicknesses are fitted together—with no voids or holes for best neutron protection.



Ferroelectricity and Ferrimagnetism In Same Material

The National Bureau of Standards has discovered a series of materials that simultaneously show both ferroelectric and ferrimagnetic properties. The generalized composition is a barium niobate containing any one of several rare earths plus iron oxide, and has a single-phase crystalline structure. As the two properties seem to be mutually dependent in these materials, the composition should find application in new electronic components where a coupling between dielectric and magnetic effects is desirable or where a magnetic material having a high dielectric constant would be useful.

U.S. Economy in 1975

The U. S. Economy will nearly double in little less than 20 years, according to economists at Arthur D. Little Inc. By 1975 gross national product will hit a record $835-billion, based on a projection from 1930. Total population of the U. S. will be an estimated 235-million; the labor force will total 94 million—an increase of 23 million wage earners. The average work week will be cut to around 35½ hours, but productivity (which has shown a gain of about 2½% annually since 1930) will soar to a record of $5.14 per man hour (vs. $3.29 per hour in 1957). Power requirements to meet higher living standards will exceed 2,100-billion kwh (compared to 600-billion in 1957).

New Publications

Aircraft and Missile Design and Maintenance Handbook, by Charles A. Overbey. Easy-to-use volume is said to be a practical handbook for draftsmen, supervisors, designers, modification engineers, specialists, and others working in aircraft factories, airports, repair and modification centers, and the military services. Over 160 tables and 40 figures illustrate the standard methods of equipment installation and maintenance. Text explains the standards and gives hundreds of tips on the proper handling of materials and tools. 369 pages, $9.75. The Macmillan Co., 60 Fifth Ave., New York 11, N.Y.

Beam and Wave Electronics in Microwave Tubes, by Dr. Rudolf G. E. Hutter. Textbook analyzes the basic physical principles of a wide range of microwave devices from early klystrons to the most recent traveling-wave tubes. D. Van Nostrand Co. Inc., 120 Alexander St., Princeton, N.J.

Tabulation of Data on Receiving Tubes, by C. P. Marsden, W. J. Keery, and J. K. Moffitt. Based on manufacturers' published specifications, this tabulation has been prepared in the form of two major listings: a numerical listing in which the tubes are arranged by tube number and a characteristic listing in which the tubes are arranged by tube type and further ordered on the basis of one or two important parameters. The tabulation is accompanied by a listing of similar tube types and basing diagrams for the listed tubes. 110 pages, $1. Order National Bureau of Standards Handbook 68 from the Supt. of Documents, U. S. Government Printing Office, Washington 25, D.C.

Productive Purchasing. New publication provides a detailed approach to the systematic appraisal of product value in business purchasing. It describes methods used to improve purchasing methods by a more scientific application of analysis techniques. A scaled checklist for evaluating equipment suppliers is included and can be used for appraisal of such added values as reliability, technical capabilities, after-sale service, availability, buying convenience, and sales assistance. A method of organizing for productive purchasing is suggested and several case histories illustrate results from typical applications of the concept. 22 pages. Order bulletin GED-3877 from Section 666, Apparatus Sales Div., General Electric Co., Schenectady 5, N.Y.

OTS Publications

The following new publications may be ordered from the Supt. of Documents, U. S. Government Printing Office, Washington 25, D.C.

Properties of High-Temperature Ceramics and Cermets, NBS Monograph No. 6,—Elasticity and Density at Room Temperature, by S. M. Lang. 45 pages, 20 cents.

MIL-STD-221A, Color Code for Resistors, Catalog No. D7.10:221A. Revised military standard establishes a uniform color code for insulated, axial-lead, composition-type and wire wound-type, fixed resistors. 8 pages, 20 cents.

ASTM Standards

Copies of the following standards or information regarding their availability may be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

Part 9, Plastics, Electrical Insulation, Rubber, Carbon Black (1959 Supplement to the 1958 Book of ASTM Standards). 546 pages, $4.

D 150-54T, Tentative Methods of Test for A-C Capacitance, Dielectric Constant, and Loss Characteristics of Electrical Insulating Materials. A new Appendix III covering air-gap and liquid displacement measurement techniques has been added.

D 1458-57T, Tentative Methods of Testing Fully Cured Silicone Rubber Coated Glass Fabric and Tapes for Electrical Insulation. Revisions clarify and make more specific the instructions for thickness measurements.

ASA Publications

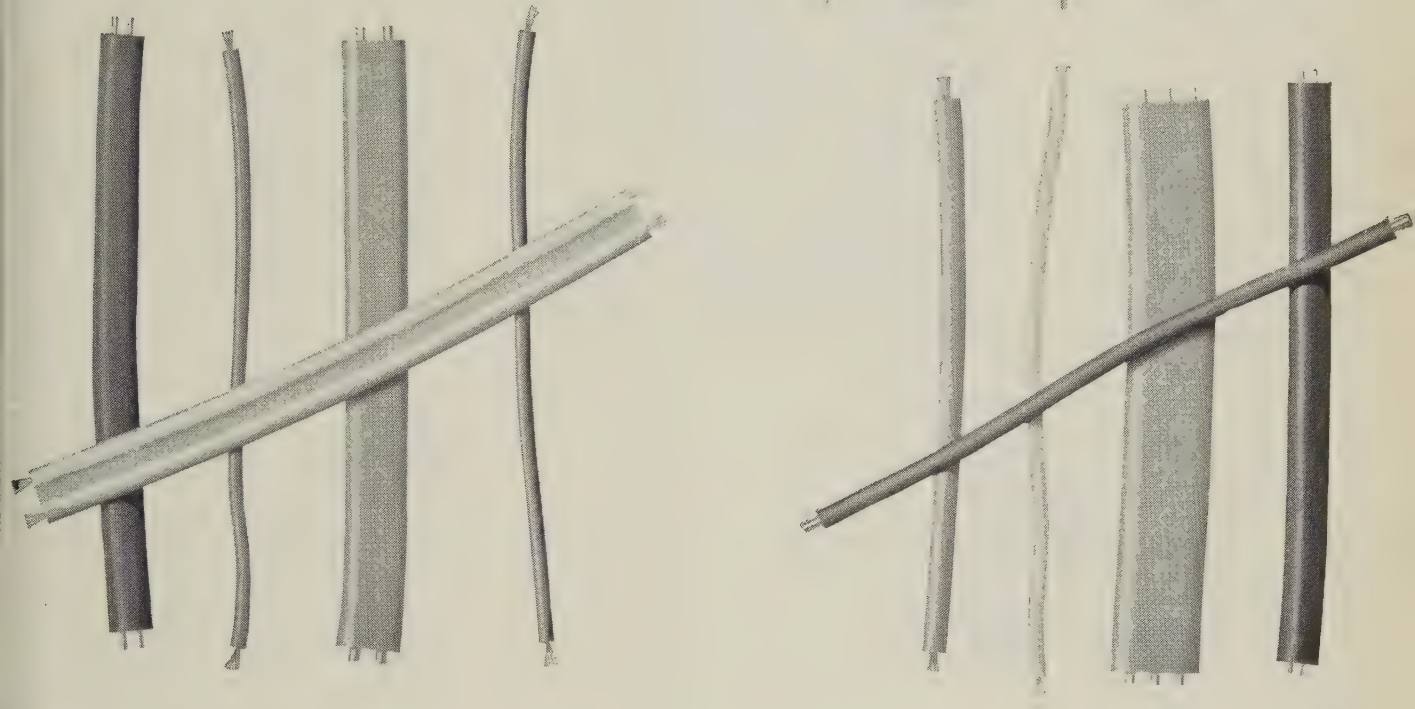
The following publications may be ordered from the American Standards Assn., 70 East 45th St., New York 17, N.Y.

Style Manual for American Standards. A new manual (*not* an American Standard) of recommended style for organization, size, layout, type specifications, and similar aspects of published American Standards. It is considerably simplified over the previous edition. $1.50.

Proceedings of the Tenth National Conference on Standards. Subjects include the automotive field, fastener industry, purchasing, materials handling, space technology, and whether American industry should convert to the metric system. Complete for $4, or in seven separate sections covering the individual conference sessions at $1 each.

IEC Publication No. 112, Recommended Method for Determining the Comparative Tracking Index of Solid Insulating Materials Under Moist Conditions. $2.40.

One for...



OPALON® 1038 vinyl compound meets .5 insulating and jacketing specifications*

onsanto Opalon 1038 fills so many applications, it can streamline your inventory. It combines cellent extrudability, high insulating qualities, great heat resistance and toughness even after long e under rigorous conditions. If you need to meet any of the specifications listed below, write for 038 data to Monsanto Chemical Company, Plastics Division, Room 752, Springfield 2, Mass.

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L. T, TW, and 60° C. oil exposure on th copper and aluminum conductors.

L. underground feeder and non-tallic sheathed cable (UF-NMC).

ss 11, U.L. standard for flexible cord d fixture wire insulation and jacket.

IPCEA Appendix I.

ASTM D-734.

MIL-W-76A, Types LW, MW, and HW.

U.L. 80° C. appliance wire.

***JACKET**

ASTM D-1047 (Passes -40° C. cold bend).

UF-NMC.

REA Spec. PE-14.

IPCEA, Appendix J.

IMSA, Spec. 19 and 20.

Inside-outside telephone cable (Staple Gun Wire).

Jan-C-17A Type I.

MIL-C-15479A (Harbor Defense).

Print Ins. 30 on Reader Service Card

Association News

ASHRAE to Meet in Vancouver

The 67th annual meeting of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers Inc. will be held in Vancouver, B.C., June 13-15. The three-day program at the Vancouver Hotel will include four technical sessions on topics allied with absorption air conditioning, refrigerants, thermoelectric effects, and heating and three symposiums covering domestic refrigerator engineering, commercial refrigeration, and air conditioning.

IRE-ISA Exhibit and Conference

Over 75 percent of the available space for the Institute of Radio Engineers-Instrument Society of America Joint Technical Exhibit has been contracted for. More than 200 firms are expected to participate in the event, to be held May 24-26 in connection with the IRE Seventh Region Conference, in Seattle, Wash. The National Guard Armory, a short distance from downtown Seattle, will be the site of the exhibits. The technical program on control systems, solid state electronics, and electromagnetics will take place at the Olympic Hotel.

Space Problems to be Discussed at Telemetering Conference, May 23-25

Engineering applications in missiles and aircraft will have a prominent place on the technical program of the 1960 National Telemetering Conference scheduled for May 23-25 at the Hotel Miramar, Santa Monica, Cal. The conference is sponsored by the American Institute of Electrical Engineers, the Instrument Society of America, the Institute of the Aeronautical Sciences, and the American Rocket Society. Theme of the conference is "Telemetry—a Tool of Industry and Defense."

NISA Convention, May 8-11

Edward S. Helm, Reliance Electric & Engineering Co., Cleveland, Ohio, will be the keynote speaker at the 27th Annual Convention of the National Industrial Service Association Inc. Helm will be the first of 13 business and professional men who will discuss the convention theme, "Management in the 'Sixties," at the four-day meeting May 8-11 in Miami Beach, Fla., at the Hotel Fountainebleau. Another speaker, Dr. Jack Wilson, Chief Physicist, The Louis Allis Co., Milwaukee, will talk on, "Can Management Evaluate New Insulation Materials?" An estimated 1,200 delegates and members of their families are expected to attend.

Two features of past NISA conventions, shop tours and discussion groups, will be discontinued this year to give members extra free time in the afternoons.

A closed meeting for NISA active members (shop owners) will be held on Tuesday afternoon after the annual luncheon and business meeting. A cabaret dinner dance and entertainment for delegates and their families will be held at the hotel on Monday night, May 9. "Exhibitors' Night" is scheduled for Tuesday and the association's traditional annual dinner will conclude the activities Wednesday evening.

Women attending the convention with their husbands will participate in a separate program of entertainment and sightseeing. A luncheon for officers of NISA's 40 local, state, and regional chapters will be held on Monday. Delegates will attend a buffet luncheon in the exhibit area on Wednesday. More than 60 firms will exhibit at the convention.

Environmental Terminology Project Initiated by ASA

A project on Environmental Terminology has been initiated by the American Standards Association. The suggested scope of the project is: "To select and to define terms to describe factors of environments." The Institute of Environmental Sciences has been invited to serve as the sponsor for the project.

Ductile Ceramics in Materials Program at ASTM Annual Meeting

The new field of ductile ceramics will be the subject of a paper to be presented by Prof. Earl R. Parker of the University of California at the 63rd annual meeting of the American Society for Testing Materials. The meeting will be held at the Chalfonte-Haddon Hall, Atlantic City, N.J., the week of June 26 to July 1.

The paper on ductile ceramics will be presented at a session on Progress in Materials Sciences sponsored by the society's new Division of Materials Sciences. Other subjects to be covered in the session include the accomplishments and limitations of solid-state theory, contributions of surface chemistry and physics, and the relationship between mechanical and electrical properties of semiconductors.

Domestic Appliance Technical Conference May 16-17

The 11th annual Domestic Appliance Technical Conference will be held in Mansfield, Ohio, on May

16-17. Among the many interesting papers to be presented are: Mechanical Problems of Electrical Contacts and Connections, by L. W. Flenner, Therm-O-Disc Inc.; The Importance of Electrical Connections in Automatic Appliances and A Practical Test for Determining Connector Reliability, by K. M. Hammell, AMP Inc.; Thermoplastics in Appliance Design, by G. Thayer, Dow Chemical Co.; Immersible Coffee Maker, by D. B. Price, Westinghouse Electric Corp.; and Positive Quality Control, by C. Wood, Whirlpool Corp.

Annual Wire and Cable Symposium Scheduled for Nov. 30-Dec. 2

The 9th Annual Symposium on "Technical Progress in Communication Wires and Cables" is scheduled to be held Nov. 30-Dec. 2. As usual, it will be located at the Berkeley-Carteret Hotel, Asbury Park, N. J. Sponsor is the U. S. Army Signal Research and Development Laboratory.

Howard F. X. Kingsley of the Fort Monmouth Laboratory is general chairman. He will be assisted by C. T. Wyman, Bell Telephone Laboratories; Ray Blain, U. S. Army Signal Engineering Agency; Richard P. Houlihan, Gavitt Wire and Cable Co; Spencer Montgomery Jr., The Montgomery Co; Ira T. Stoneback, International Telephone and Telegraph Laboratories; H. L. Wuerth, B. F. Goodrich Chemical Co., and Fred W. Wills, Signal Research and Development Laboratory.

The attendance at the symposiums has grown from 433 the first year to well over 1,000.

Name Board Members for Two Reorganized NEMA Divisions

Board members have been named for two more divisions in the National Electrical Manufacturers Association.

C. H. Bartlett has been elected chairman of the Generation, Transmission, and Distribution Equipment Division, the third to be announced under NEMA's recently approved reorganization plan.

Frank H. Roby, Federal Pacific Electric Co., has been elected chairman of the Building Equipment Division.

Industry News

W. J. Ruscoe Co., Akron, has appointed *C. J. Voneman Co.*, Cleveland, as sales representatives for its "Perma-Form" insulated coil retainer stock in Ohio, western Pennsylvania, Indiana, and Michigan.

Atlas Engineering Co Inc., Roxbury, Mass., is constructing a 15,000

sq. ft. electronics plant in the Natick, Mass., industrial center to house a subsidiary, *Atlas Controls Inc.*

Directors of *Gorham Mfg. Co.*, Providence, R.I., silversmiths and electronic components manufacturer, and *Pickard & Burns Inc.*, Needham, Mass., electronics systems producer, have approved terms of the acquisition by Gorham of all the assets of Pickard & Burns. Pickard & Burns will be operated as a wholly-owned subsidiary.

Anodyne Inc., anodizing and pressure-sensitive marker manufacturer, expects to occupy a new 28,500 sq. ft.

plant at Sunshine State industrial park, North Miami, Fla., in June.

Milo Electronics Corp., New York City, distributor, has established a New England sales office and warehouse at Newtown, Conn.

Pyrometer Co. of America Inc., Penndel, Pa., manufacturer of thermocouples, has appointed *Clifford B. Ives & Co. Inc.*, Narberth, Pa. as its representative in the Greater Delaware Valley Area.

Shielding Inc., Riverton, N.J., manufacturer of shielded rooms, has

opened a second plant containing 16,500 sq. ft.

The standard type E "Teflon" insulated hook-up wires produced by *American Super-Temperature Wires Inc.*, Winooski, Vt., have been recognized under the Appliance Wiring Material Program of the Underwriters' Laboratories Inc.

Fibrous Glass Products Inc., a subsidiary of *Pall Corp.*, manufacturer of molded fiber glass, is constructing a 26,000 sq. ft. building in Syosset, L.I., N.Y.

Associated Testing Laboratories Inc., Caldwell, N.J., environmental testing equipment manufacturer, has opened a 10,000 sq. ft. environmental testing facility in Orlando, Fla.

Ground is shown being broken for a 35,000 sq. ft. addition at *Radio*

Frequency Co. Inc., Medfield, Mass., producer of high frequency induction and dielectric generators.

Arrangements providing for distribution by *Hastings Plastics Inc.* of the epoxy hardener formulations manufactured by *Applied Plastics Co.* have been completed by the two southern California firms.

Air Accessories Inc., Fort Worth, has been merged into the *Texstar Corp.*, San Antonio, with Air Accessories now being known as *Texstar Plastics*, Div. of the Texstar Corp.

Sunbeam Corp., Chicago appliance manufacturer, has acquired *John Oster Mfg. Co.*, Milwaukee, appliance and instrument manufacturer.

Nadic methyl anhydride, a liquid epoxy curing agent that has been in short supply, now is available in ample quantities following the expansion of production facilities at the Buffalo plant of *Allied Chemical's National Aniline Div.*

S. S. White Co., Plastics Div., has appointed *Blumberg Supply Corp.*, Hempstead, L.I., N.Y., as its distributor.

Edward A. Damrau Co., Pittsburgh, has been appointed a sales representative by the *Boston Woven Hose & Rubber Div.* of the *American Biltrite Rubber Co.*, Boston, for the company's line of friction, rubber, and plastic tape.

Thermal Controls Inc. and *O.K. Electronics Corp.*, both of Nutley, N.J., are uniting under one name, that of *Thermal Controls Inc.*

Electronic Transistors Corp. has been formed at North Bergen, N.J. to produce transistors.

Metachem Resins Corp., Cranston, R.I., has been formed to produce epoxy and polyester resin formulations. Herbert L. Spivack, formerly with Isochem Resins Corp., has been named president.

Hermetic Seal Corp., producer of glass-to-metal and ceramic-to-metal

electronic seals, has moved to a new 15,000 sq. ft. building at North Arlington, N.J.

The Dayton Rubber Co., Dayton, producer of electrical tapes, urethanes, and rubber products, has changed its named to *The Dayco Corp.*

The *Polymer Corp.* has formed two new divisions. The *Whirlclad Div.* is assuming all the activities of *National Polymer Products Inc.*, formerly a subsidiary. The *Molding Resins Div.* is assuming activities related to molding compounds.

Duramic Products Inc. has moved from New York City into a new 5,000

sq. ft. plant at Palisades Park, N.J. for the production of ceramics.

Industrial Plastics and Chemicals, Oakland, Cal. has been named a distributor by *Hastings Plastics Inc.*, Santa Monica.

Sales of the *Du Pont Co.* advanced 16% in 1959 over 1958 and established a record for the company of $2,114-million, passing the two-billion dollar mark for the first time. Earnings after taxes were $8.92 per share compared with $7.25 for 1958.

Polymer Corp., Reading, Pa., plastics processor, reports 1959 sales of $7,130,000, an increase of 52% over 1958. Earnings increased 166% to $517,000.

Atlas Powder Co., Wilmington, Del., has reported net earnings in 1959 rose nearly 36% to $3,907,000. Total revenues for 1959 were $70,721,000.

The Borden Co., New York, reports 1959 sales of $941,326,495 and net income of $25,548,693.

The Sylvania Electronic Systems, Div. of Sylvania Electric Products Inc., has announced plans for a new applied research laboratory facility and headquarters building, each totaling approximately 45,000 sq. ft., on a 55-acre site in Waltham, Mass. The *Chemical and Metallurgical Div.* has announced plans for a $500,000 facilities expansion program for the production and processing of single crystal germanium and silicon for use by the semiconductor industry.

Tri-Point Plastics Inc., Albertson, L.I., plastics producer, plans to con-

struct a new 15,000 sq.ft. plant exclusively for the processing of "Teflon" resins.

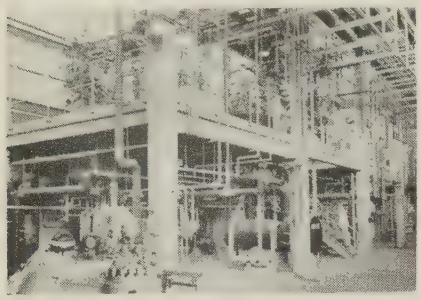
Technical Industries Corp., affiliate of *Packard-Bell Electronics*, Pasadena, Cal., and producers of insulated connectors, wire, potting compounds, and components, has changed its name to *Physical Sciences Corp.*

Products Research Co., Pasadena, Cal., producer of coating and potting compounds, is completing construction of its new 11,000 sq.ft. building which will house corporate headquarters facilities adjacent to present laboratories.

A new *Special Products and Research and Development Div.* has been formed by *The Electric Autolite Co.*, Toledo, to facilitate diversification

programs of the company. George E. Spaulding, Autolite director of research, will head the new division.

Silicones Div., Union Carbide Corp., has completed its new three-



story 155 by 66-foot new process development building at Long Reach, W.Va.

Rayclad Tubes Inc. has appointed *Insulation Manufacturers Corp.*, Chicago, Cleveland, and other cities, and the *Robert McKeown Co. Inc.*, Livingston, N.J., as franchised stocking distributors for "Thermofit" tubing and sleeving materials. Rayclad, as well as its parent company, *Raychem Corp.*, Redwood City, Cal., have also made the following sales representative appointments: *Henschen, Jensen & Co.*, Detroit, *Baehr, Greenleaf & Assoc. Inc.*, Cleveland, and *R. W. Farris Co. Inc.*, Kansas City, Mo.

In order to further control and improve the electrical characteristics of its pressure sensitive tape, *Thermoid Div., H. K. Porter Co. Inc.*, Trenton,

is spending approximately $225,000 on new manufacturing equipment. New equipment will utilize results of laboratory tests to improve tape quality.

Spaulding Fibre Co. has announced plans for a major addition to its present fabricating division facilities at Tonawanda, N.Y., as part of a $1,250,000 expansion program for 1960. The addition is designed to increase production of parts fabricated from vulcanized fibre and laminated plastics.

Missile Systems Corp., electronic systems manufacturer, has organized a new cabling division to operate at the company's North Hollywood, Cal., plant.

Boston Woven Hose & Rubber Co., division of *American Biltrite Rubber Co. Inc.*, Boston, plans construction of a new 200,000 sq.ft. plant in Hohenwald, Tenn., costing approximately $3,000,000.

Cincinnati Development & Mfg. Co., Cincinnati, has completed a 100% expansion of facilities for production of glass mat polyester electrical laminates.

The *National Bureau of Standards*, Washington, has established a new scientific division, *Atomic Physics*, by partitioning the *Atomic and Radiation Physics Div.* Dr. Louis M. Branscomb is chief of the new division.

Kollsman Instrument Corp., Elmhurst, L.I., has acquired *Richardson-Allen Corp.* for an undisclosed sum of cash. Richardson, to be operated under its own name as a wholly-owned subsidiary, manufactures transformers.

DeArmond Enterprises Inc., Los Angeles, has been formed for the purpose of developing procurement and test specifications for use by the avionics industry. Frank B. DeArmond is president.

B. F. Goodrich Co., Akron, rubber and plastics producer, plans to spend approximately $50,000,000 in 1960 for improved facilities and equipment.

Light & Power Utilities Corp., manufacturer of lighting fixtures, has completed construction of its new $600,000 plant in Olive Branch, Miss.

Robotron Corp., Detroit, has split its product lines into four divisions as follows: Resistance Welding, Automation Devices, Regulators, and Induction Heating.

Inductotherm Linemelt Corp., Delanco, N.J., has been formed to manufacture core-type induction melting equipment. J. Lloyd Hoff is president and Alfred A. Coley is vice president.

J. L. Hoff

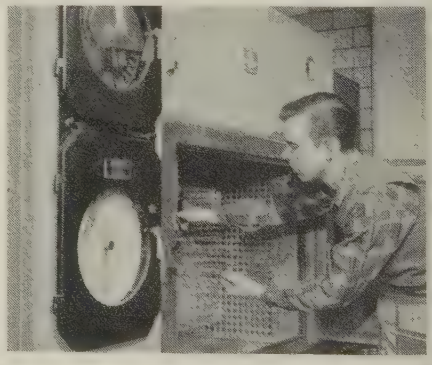
A. A. Coley

Atlee Corp., electronic component producer, has acquired and merged with *Industrial Electronics Co. Inc.* and *Applied Dynamics Corp.* The new company will continue under the Atlee name and will maintain headquarters at a new plant in Waltham, Mass.

Jacob Lichman, Sydney Comins, and Adrian Comins have formed *Key Polymer Corp.* at Lawrence, Mass., to develop and produce adhesives and coatings from epoxy and polyurethane polymers.

Catalytic Combustion Corp., Detroit, has formed a European subsidiary, *KAVAG* at Gondsroth, West Germany, to manufacture catalysts and catalytic combustion systems. Erwin C. Betz, former Catalytic Combustion engineer, has been named managing director of the new subsidiary.

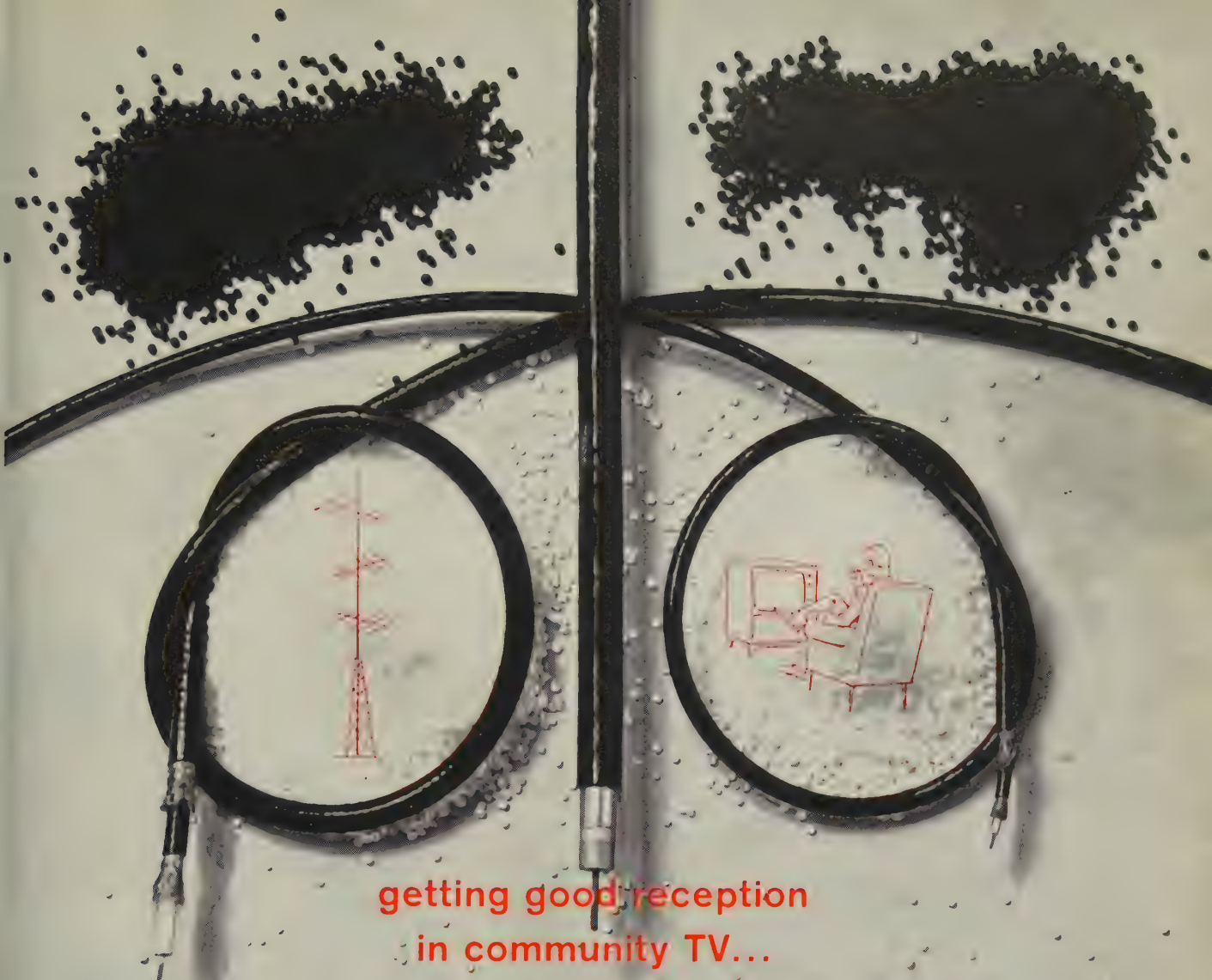
Formica Corp., Cincinnati laminated plastics producer, has added



two new "Climate-Labs" to its testing facilities.

Synthane Corp., Oaks, Pa., laminated plastics producer, has increased its laboratory space and equipment by 30%.

Negotiations to acquire for cash the Microsen electronic instrument business of *Manning, Maxwell & Moore Inc.*, Stratford, Conn., have been concluded by *Robertshaw-Fulton Controls Co., Aeronautical and Instrument Div.*, Anaheim, Cal.



getting good reception
in community TV...

Mohawk's H-F coaxials, jacketed and insulated with TENITE POLYETHYLENE

For community television distributing systems in any area, Mohawk H-F coaxials do a complete transmission job, from tower or relay station right into the living room.

Tenite Polyethylene is used as jacketing and insulating material on these cables. It offers all-round high performance which gives them long life, keeps line loss low, and permits ease in installation.

As a jacketing material, tough Tenite Polyethylene provides excellent resistance to abrasion, weathering, moisture, and heat. Users can look forward to years of maximum protection.

As an insulating material, Tenite Polyethylene has a low power factor, which holds energy losses to a minimum. In these Mohawk cables, both solid and foamed Tenite Polyethylene are used for primary insulation... the foamed material having an even lower dielectric constant than the solid, thus making possible a thinner insulation with a resulting decrease in cable weight.

Linemen find that cable jacketed with lightweight Tenite Polyethylene is easy to handle and strip and is flexible even at sub-zero temperatures.

There is a formulation of Tenite Polyethylene to meet the demands of most insulating and jacketing applications. For further information on this useful plastic, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

● *Both natural and black electrical grade Tenite Polyethylene are available to cable manufacturers as unique spherical pellets which flow freely in the extrusion process and in "air-veying" bulk shipments from truck to bin.*

● *Cable manufactured by Mohawk Wire & Cable Corporation, 320 River Street, Fitchburg, Massachusetts. Jacketing and insulation extruded of Tenite Polyethylene.*

TENITE®
POLYETHYLENE
an Eastman plastic

S-Y

THE NEW BONDEZE® WIRE FOR SELF-SUPPORTING COILS...PHELPS DODGE

Bondeze®

A self-bonding wire—now with improved and added properties!

Improved in three important ways:

- Extra resistance of underlying film to temperature-pressure "cut-thru." Reduces shorts.
- Crazing negligible when solvent bonded.
- Underlying film gives better thermal life.

...and with this newly added property:

- Easy solderability . . . solders or dip-tins at low temperatures without cleaning or stripping. No damage to copper conductor.

Phelps Dodge S-Y Bondeze® magnet wire bonds turn to turn with a single application of heat or solvent. This important property, combined with improved thermal characteristics and easy solderability, opens a new and wider range of applications for self-supporting coils or bobbin-less coils and windings.

Any time your problem is magnet wire, consult Phelps Dodge for the quickest, surest answer!

FIRST FOR LASTING QUALITY —FROM MINE TO MARKET!

PHELPS DODGE COPPER PRODUCTS CORPORATION

INCA MANUFACTURING DIVISION

FORT WAYNE, INDIANA

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Aluminum Power Cable For Railroad Cars

Aluminum power cable installed in new "push-pull" commuter cars being used by the Chicago and North Western Railway is said to cost 30 percent less than equivalent copper cable. Lighting, heating, and air conditioning units in each car are supplied with power by 1,200 feet of 250 MCM single conductor, rubber insulated, neoprene sheathed cable supplied by Kaiser Aluminum & Chemical Sales Inc. The cars are ten tons lighter than conventional two-decker cars. Photo

at left shows the train being pushed into Chicago with the engineer controlling it from the lead coach. At right, the aluminum power cable is seen in open installation beneath the train.

Thermometry For Low Temperatures

In an attempt to provide higher-precision thermometry in the range from 90 down to 20°K (—183 to 253°C), and to provide a calibration service for secondary thermometers from 20 down to 2°K, the National Bureau of Standards is expanding its low-temperature research program. Steps will also be taken toward establishing fixed points and extending the International Temperature Scale below 90°K, where there is now no international agreement. The measurement of low temperatures is growing in importance because of recent advances in cryogenic techniques, and because physicists and chemists need a practical and reliable working scale when they determine specific heats, thermal conductivities, and other fundamental properties of materials at these temperatures.

PLYMOUTH — the complete line of harness wrapping tapes

#7 SLIPKNOT, VINYL, PRESSURE-SENSITIVE

VINYL, HAND ROLL, NON-ADHESIVE

CLOTH, FRICTION ONE SIDE OR PRESSURE-SENSITIVE

SLIPKNOT FRICTION TAPE, BLACK OR BROWN

VINYL, MACHINE ROLL NON-ADHESIVE OR PRESSURE-SENSITIVE

DEPENDABILITY · VERSATILITY · ECONOMY

From the thinnest non-adhesive vinyl to heavy-duty special adhesive cloth, from standard adhesives to special-service formulations, Plymouth Harness Wrapping Tapes cover virtually every wire assembly need. Shown above are just a few stock types — but we daily make hundreds of special combinations to order.

We will be pleased to provide samples and specification data to your requirements. Write on your business letterhead to Division H.

VINYL TAPES, non-adhesive
.005" — .007" — .009" —
.010" — .012" — .014" — .020"
(105°C — .005" — .010" — .012")

VINYL TAPES, pressure-sensitive

CLOTH TAPES
Frictioned one side — vinyl-coated
pressure-sensitive — standard friction

Core sizes to your needs

CONFORM TO GOVERNMENT SPECIFICATIONS

PLYMOUTH RUBBER COMPANY, INC.

QUALITY SINCE 1896

CANTON, MASSACHUSETTS

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People in the News

Magnetic Controls Co., Minneapolis, has promoted *Harold C. Hanson* from assistant chief engineer to chief engineer and has named *John J. Melhoff*, formerly with Remington Rand Univac, St. Paul, as purchasing agent.

The Dayco Corp., formerly known as the Dayton Rubber Co., Dayton producer of tapes, urethanes, and rubber products, has named *L. J. Keyes* to the newly created post of vice president and director of purchases.

Ben Winston has been appointed to the Eastern Div. "Teflon" sales staff of Tri-Point Plastics Inc., Albertson, N.Y.

Henry C. Guhl, with the company since 1954, has been elected vice president for engineering after previous service as engineering manager with National Vulcanized Fibre Co., Wilmington, Del., fibre and laminated plastics producer.

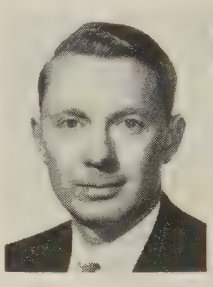
H. C. Guhl

H. E. Love

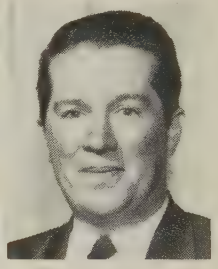
H. Earl Love, previously with the Philadelphia sales office, has been appointed assistant sales manager Eastern Div. for the Pyrometer Co. of America Inc., Penndal, Pa., thermocouple manufacturer.

Robert F. Scalise, former sales representative, has been promoted to district sales manager for the Warren Parts Div. of Sylvania Electric Products Inc., Warren, Pa., manufacturer of plastics, wire, and other products. He'll be in charge of ten southeastern and mid-central states. The Sylvania Home Electronics Div., has appointed *Bernard Amos* as manager of radio and stereo high fidelity design, and George P. Lyon as administrative engineer in Batavia, N.Y. Sylvania Semi-conductor Div. has appointed *Dean M. Unger* and *Richard C. Tonner* as product line managers, and *Joseph P. Colesworthy* as sales engineer in the Los Angeles office. Unger and Tonner are located at the Woburn, Mass., plant.

Crouse-Hinds Co., Syracuse, N.Y., electrical equipment and fittings manufacturer, has named *Austin D. Vanderbilt* as manager of industrial engineering and *Richard W. Scott* as administrative engineer in the engineering division.



A. D. Vanderbilt



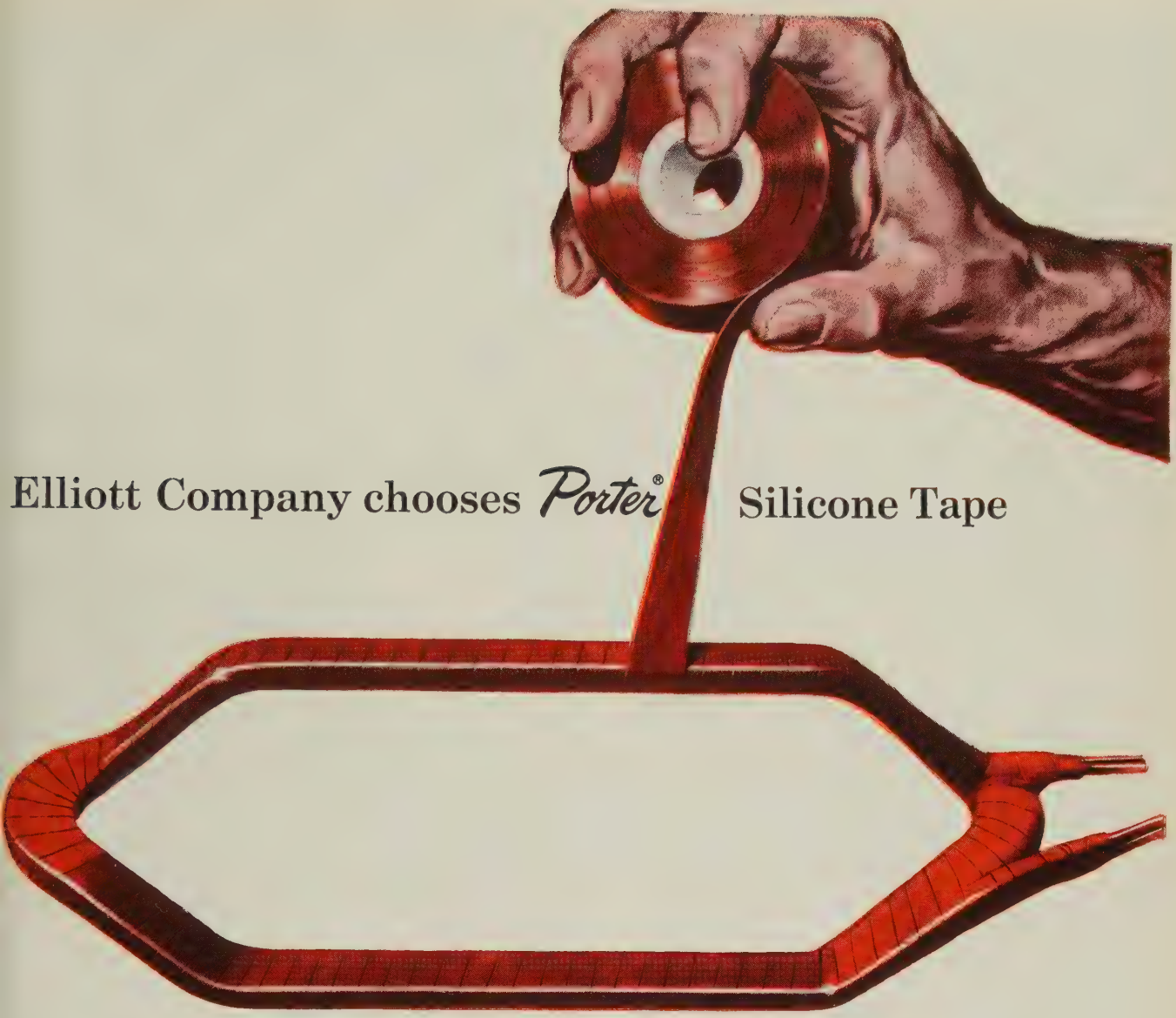
R. W. Scott

D. B. Scott, former manager of the rectifier section, has been named manager of the control dept., Allis-Chalmers Mfg. Co., Milwaukee. In the Allis-Chalmers General Products Div., *Robert G. Bengston* has been named application engineer in the industrial systems dept., and *Dale K. Russell* has been appointed application engineer in the electrical dept., Norwood Works. In the Allis-Chalmers Power Equipment Div., *L. W. Harris* and *William H. Spiller* have been named assistant engineers in the steam turbine dept., and *Edward J. Kleine* has been appointed application engineer in the regulator dept. Allis-Chalmers has also announced the formation of the power systems engineering dept. under the management of T. G. A. Sillers. It will be a part of the Power Equipment Div.

P. J. Katzoff, a founder of Kings Electronics Co. Inc., Tuckahoe, N.Y., has retired from active participation in the company.

John W. Weseloh, with the government since 1942, has been appointed chief engineer of the U.S. Army Signal Equipment Support Agency, Ft. Monmouth, N.J.

Associated Testing Laboratories



Elliott Company chooses *Porter*® Silicone Tape

for mechanical stability and extended motor life!

After extensive research into new materials and methods, Elliott Company, a division of Carrier Corporation, has developed the first really mechanically-adequate silicone insulation system—with "Porter" Silicone Tape. Vulcanized into a void-free homogeneous structure, "Porter" Silicone Tape provides outstanding mechanical and sealing properties for applications requiring class H insulation. In addition to flexibility and moisture protection, the Elliott "Fabri-Lastic" system provides durability and toughness as well as excellent thermal stability at high temperatures.

Thermoid Division offers the widest range of silicone tapes on the market today. And continuous research and development is being conducted to make available silicone elastomer materials with characteristics to meet customers' constantly changing needs. Thermoid Division engineers are available to work with you, as they worked with the Elliott Company, to develop the right combination of silicone elastomer and compatible materials for your requirements.

For fresh stocks of "Porter" Silicone Tape or information on special design characteristics, write *Thermoid Division, H. K. Porter Company, Inc., 200 Whitehead Road, Trenton 6, N.J.*

Ask for this free brochure with actual tape samples.

THERMOID DIVISION PORTER **H. K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

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Inc., Caldwell, N.J., has named *Robert Goldsmith* to manager, contract engineering.

James Marmor, formerly with Lockheed Aviation, has been named contract coordinator of the military products dept., marketing division of The Garlock Packing Co., Rochester, N.Y., plastics firm.

James Marmor

R. C. Clark

Robert C. Clark, formerly a buyer with United Aircraft Corp., has joined Taylor Fibre Co., Norristown, Pa., laminated plastics and fibre producer as a sales engineer in the New England district sales office at Hartford, Conn.

Nat B. Kaufmann, president of Tevco Insulated Wire, Burbank, Cal., has acquired this extruded plastics wire manufacturing company. *Bernard Nelson* is secretary and general sales manager. *Rolland Trombley* is vice president and general plant manager.

Don Singer, formerly assistant general manager of Emerson Plastics Corp., has been appointed special assistant to the director of sales at Tri-Point Plastics Inc., Albertson, N.Y.

William A. Matthews, formerly with Sperry Gyroscope Co., has been appointed works manager of Kollsman Instrument Corp., Elmhurst, N.Y.

W. A. Matthews

Wendell Guy

Wendell Guy, with the company for nine years, has been appointed to the newly created position of staff manager in charge of methods engineering and quality control for Moxness Products Inc., Racine, Wis., silicone rubber manufacturer.

R. A. Hanke has been appointed Chicago electrical sales representative by the Boston Woven Hose & Rubber Div. of American Biltrite Rubber Co., Boston, manufacturer of friction, rubber, and plastic tape.

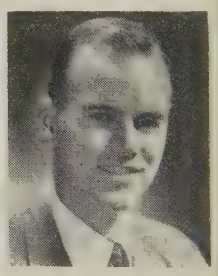
Dimitri G. Soussloff, formerly with Scott Paper Co., has been appointed to the newly created position of manager of American Machine & Foundry Co.'s Mechanical Development Laboratory, Springdale, Conn. *Robert W. Pearson*, formerly director of manufacturing for AM&F's Government Products Group, has been appointed to the newly created staff position of director of production for the company.

D. G. Soussloff

R. W. Pearson

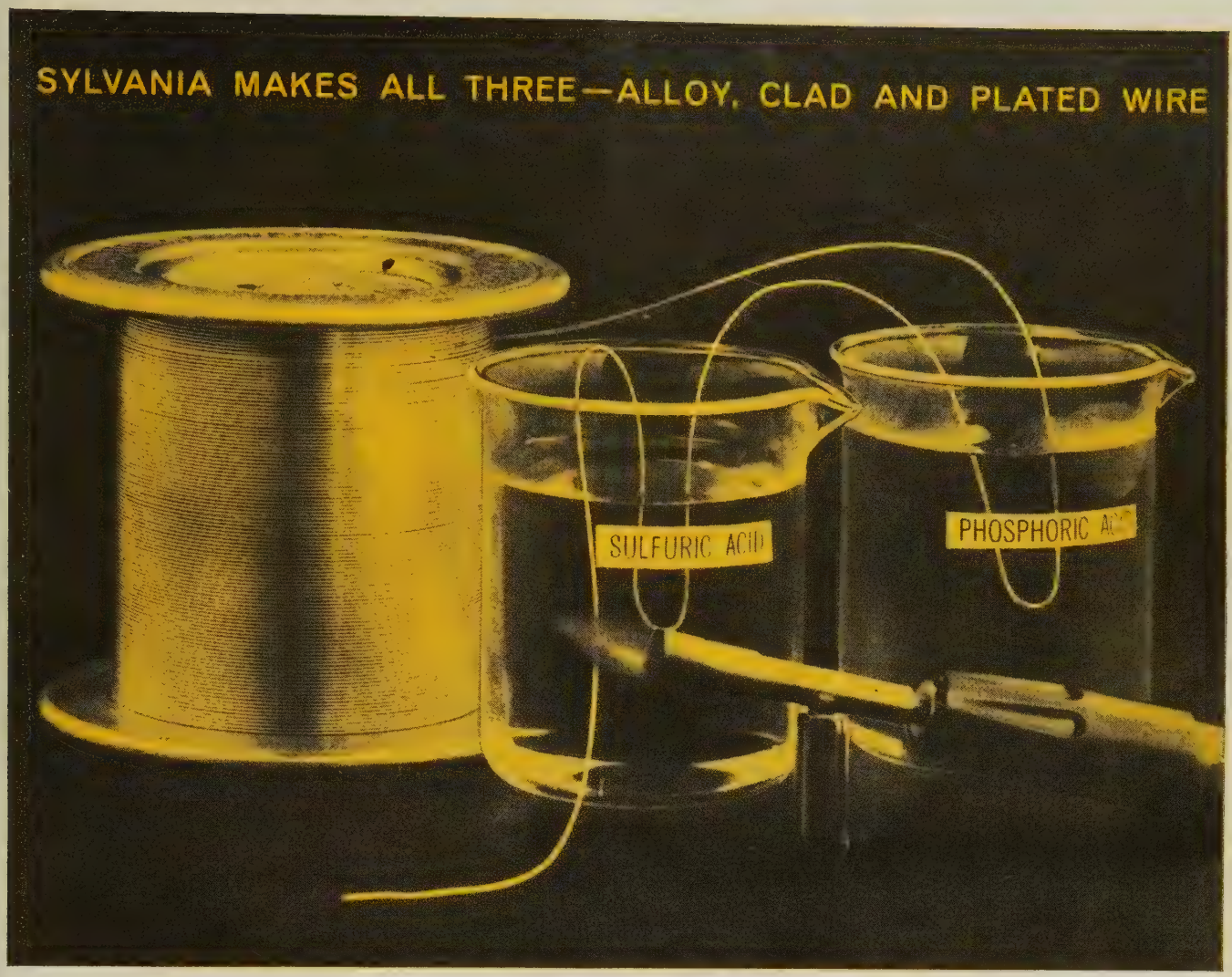
Stewart W. Schulmeyer and *James J. Secor Jr.* have been promoted to new positions in the Glass Textile Section of Johns-Manville Sales Corp., Toledo. Schulmeyer becomes staff manager of plastic reinforcement sales which include sales of glass roving products for use in electrical laminates and other reinforced plastic products. Secor, formerly regional staff manager at Chicago, replaces Schulmeyer as staff manager for electrical and industrial yarn sales.

S. W. Schulmeyer



J. J. Secor

T. D. Daniels, formerly Western district manager for the Silicone Products Dept. of General Electric Co., has been named sales manager for the Insulating Materials Dept. in Schenectady. *Leonard J. Sacks* replaces Daniels as Western district



New Sylvania nickel-clad silver 20% wire passes the acid test—beats the heat

—another reason why Sylvania gives unbiased recommendations on wire

New Sylvania nickel-clad silver 20% wire has all these outstanding properties: excellent electrical conductivity, corrosion resistance superior to silver wire, ability to withstand temperatures up through 1500°F. As a result, it's ideal for electrical hookup wire where conditions call for critical service, long life under oxidizing, corrosive or high-temperature environments.

This new wire is available from .005″ to .125″ diameter, in a variety of tempers from dead soft to full hard.

It is another example of how you can simplify your design and specification problems by getting a Sylvania recommendation on wire. Sylvania knows wire, knows the particular advantages of each kind. In fact, of all major manufacturers, only Sylvania makes all three types of bare wire—alloy, clad and plated.

Why not get full details and timesaving technical assistance today. Simply write Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

GENERAL SYSTEM

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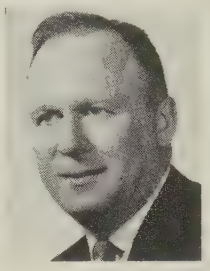
sales manager for the Silicone Products Dept. at Downey, Cal. The Chemical Materials Dept. has named *Robert M. Kavish* as West Coast salesman with headquarters at San Mateo, Cal.

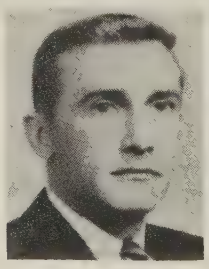


L. J. Sacks

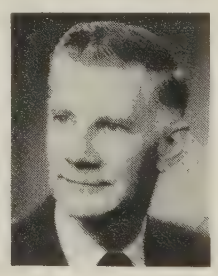
N. L. Greenman

Norman L. Greenman, former director of marketing, has been elected vice president of marketing for Rogers Corp., Rogers, Conn., manufacturer of plastic and fiber insulation materials. The company has also promoted two sales engineers to new positions as regional sales managers—they are *Walter A. Hayes Jr.* and *Robert G. Lanzit.*

John F. O'Brien has been appointed technical field salesman in Southern California for Hysol of California, a division of Hysol Corp., Olean, N.Y., epoxy compound producer.



J. F. O'Brien

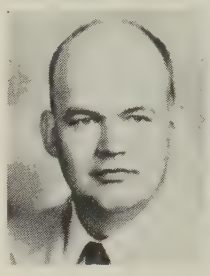


M. E. McCrosson

M. E. McCrosson has been elected vice president of the Textile Div. of Russell Manufacturing Co., Middletown, Conn., woven glass electrical tape producer. He has been manager of the Textile Manufacturing Div. since 1955.

Dr. Robert Malm has been appointed senior engineering specialist at the Amherst Engineering Laboratory, Sylvania Electric Products Inc., a facility of the Buffalo operation of Sylvania Electronic Systems. At Waltham, Mass., Sylvania Electronic Systems has named *Louis H. La Forge Jr.* as staff specialist, components and reliability.

U. S. Industrial Chemicals Co., polyethylene producing division of National Distillers and Chemical Corp., has named *Clifford E. Oman* as assistant to the director of production. *James R. Smith*, plant manager at Tuscola, Ill., has been named to assume full responsibility for the Tuscola plant operations. *Donald O. McCarthy* has been named assistant production manager for polyethylene resins.

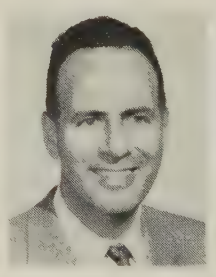


C. E. Oman

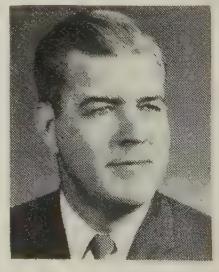
J. R. Smith

Walter S. Ainsworth, previously Cleveland assistant district manager, has been appointed supervisor of magnet wire sales for the Inca Div. of Phelps Dodge Copper Products Corp., Ft. Wayne, Ind.

John Delmonte, president and general manager of Furane Plastics Inc., Los Angeles epoxy resin producer, has been honored by being named "Outstanding Business Man of the Year" by the 1400-member Los Angeles Chapter, National Association of Accountants. Furane has announced the addition of four new members to its sales staff—*Joseph M. Hentz, John D. Thomson, Patrick B. Gallagher,* and *J. Allen Havens.*



John Delmonte



J. L. Flynn

James L. Flynn, formerly sales manager of electrical products at the Dobeckmun Co., Div. of the Dow Chemical Co., has joined the C. J. Voneman Co., Cleveland, manufacturers agents handling electrical insulation.

Frank G. Gustafson has been appointed supervisor of the process engineering dept. in plant 7 at Norton Co.,

Worcester, Mass.

Former president *Charles Allen Thomas* was elected chairman of the board of directors and former executive vice president *Charles H. Sommer* was elected president of Monsanto Chemical Co. recently.

Two new appointments have been announced by the Electric Autolite Co.'s Wire and Instrument Div. *John M. Gerber,* previously manager of the Hazleton, Pa. wire and cable plant, has been named general manager of the division. while *Edward A. McNally*, who previously headed the Port Huron, Mich., wire and cable operation, has been put in charge of both the Port Huron and Hazleton plants.

Edward J. Sinnott has been elected president of Reinforced Molding Corp., Monroeville, Pa., producer of reinforced molded materials for electrical insulation.

Lt. Gen. *James M. Gavin* (USA ret.) has been elected president of Arthur D. Little Inc., Cambridge, Mass. research company.

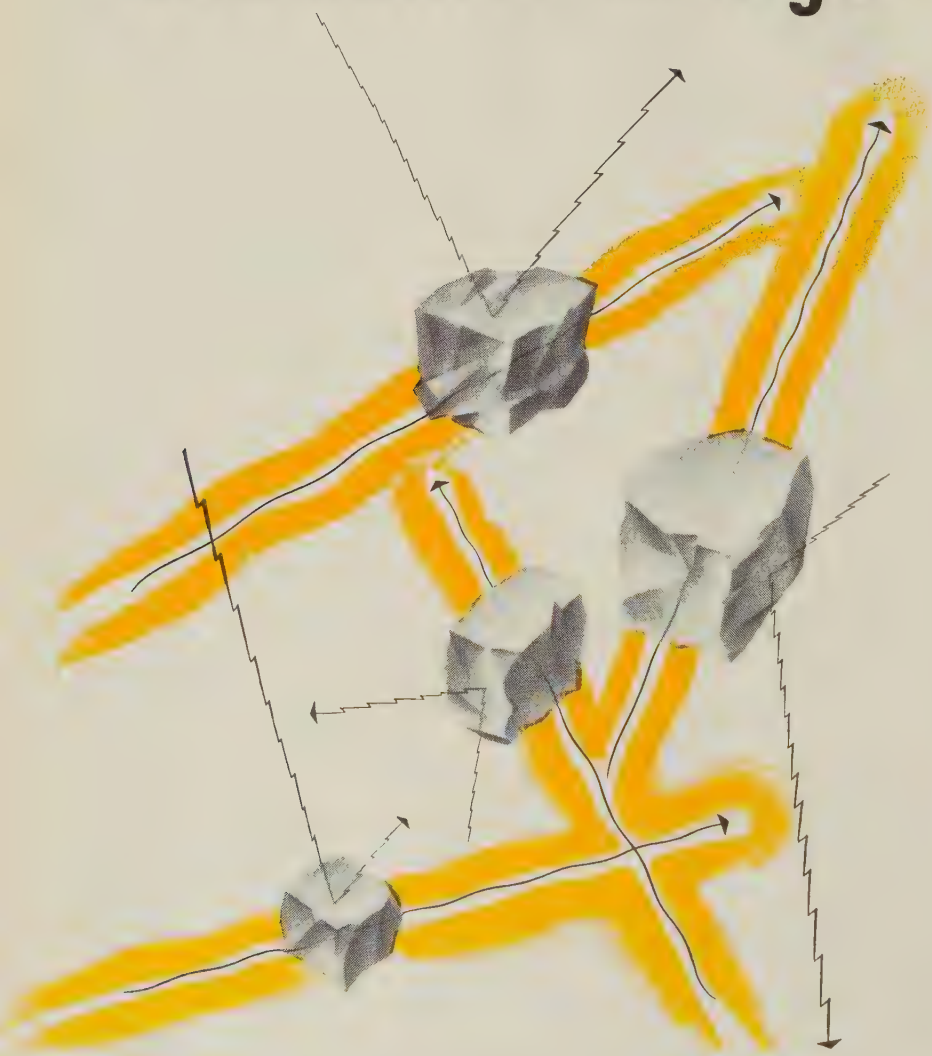
Telex Inc., St. Paul electronics firm, has named *Byron D. Smith* assistant vice president of administration and *Donald K. Sampson* assistant vice president of engineering for the Data Systems Div. *Robert R. Reisinger* has been named mechanical design supervisor in the company's Systems and Special Products Div.

Paul A. Doorley has been named plant manager of Permali Inc., Mt. Pleasant, Pa., manufacturer of laminated plastic insulation.

The Irvington Div. of Minnesota Mining & Mfg. Co., St. Paul electrical insulation producer, has made the following appointments: *Erwin W. Brown,* former manager of the plastics dept., has been named manager for electrical products. *Jerry Bolles,* formerly sales manager for the plastics dept., has been named sales manager for OEM electrical products. *Frank A. Kelly,* who had been sales manager for motor repair trades products of the coating dept. and for electrical industrial trades, has been named sales manager for electrical products for motor repair trades. *Gordon C. Brown* has been appointed manager of special products and *W.*

Outstanding
by Nature . . .
Improved
by NORTON . . .

MAGNORITE* Fused MgO



The inherent capabilities of magnesium oxide are vastly improved by Norton Company processing. Selected grades of magnesia are transformed in our electric furnaces into high purity MAGNORITE fused magnesium oxide — a crystalline material with extremely useful chemical and physical properties.

Norton MAGNORITE fused MgO is available in a complete range of grades, granular sizes and in a variety of fired shapes. For example, one top grade offers the following properties: *High Electrical Resistivity* (10^8 *ohm-cm at 900°C*). *High Melting Point* (*2800°C*). *Good Thermal Conductivity* (*0.023 Cal • Sec*$^{-1}$ *• Cm*$^{-2}$ *• °C*$^{-1}$ *at 700°C*). *High Chemical Purity* (*99.5% MgO*). *High Chemical Stability with Most Metals. Readily Crushable. Easily Packed to High Densities.*

MAGNORITE fused MgO is the world's most widely used brand . . . for containing special metal melts and keeping them free from impurities . . . as insulation for thermocouples and sheathed electrical heating elements . . . as an ingredient of ceramic electronic components. Infrared transmission through single crystals is excellent. And these are just a *few* of the uses for this versatile material.

Investigate *all* of the advantages of MAGNORITE fused MgO and how it can benefit your product or process. Write regarding *your* specific application and for complete details. NORTON COMPANY, 584 New Bond St., Worcester 6, Massachusetts.

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NORTON
REFRACTORIES
Engineered . . . Rx . . . Prescribed

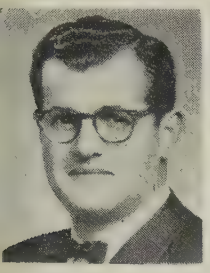
75 years of . . . Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Print Ins. 44 on Reader Service Card

G. Sweet has been appointed sales manager for special products. *Daniel J. MacDonald* has been named technical director and *Harold Fink* has been appointed production manager.

David B. Nichinson, former vice president in charge of engineering, has been elected president of Kollsman Instrument Corp., New York.



D. B. Nichinson

R. S. Fisher

Roy S. Fisher has been appointed administrative vice president of National Vulcanized Fibre Co., Wilmington, Del., plastics and fibre producer. He will be in charge of sales, marketing, traffic, industrial relations, and order service departments. The company also announced that the following four chemists have joined the Research and Development Laboratory —*Robert F. Ginn, Daniel E. Kane, Raymond H. Fowler,* and *Florian J. Zukas.*

Arthur W. Keough has been appointed quality control manager of the Los Angeles division of the Avnet Electronics Corp., electronic components producer.

John R. Caulk Jr., former executive vice president, has been elected president of the Hussmann Refrigerator Co., St. Louis.

Benjamin H. Ciscel, former senior vice president of Electronics Specialties Co., Los Angeles, has been appointed general manager of Vought Electronics Div., Chance Vought, Dallas.

Serge Rubin has been appointed design engineer for Digitran Co., Pasadena, manufacturer of advanced digital components.

Endevco Corp., electronic instrumentation firm of Pasadena, has appointed *Howard C. Wheeler* as supervisor, calibration and test dept., and *John Haggarty* as special products engineer.

Roland Gray, previously with Continental-Diamond Fibre Corp., has

been named to head a new product development group established by Tri-Point Plastics Inc., Albertson, N.Y., "Teflon" producer.

David G. Cameron has been appointed as sales engineer for the F. J. Stokes Corp., Press Div., in the New England territory.

Robert M. Stroman has been promoted to manager, Buffalo sales district and *Edward F. Borro Jr.* to assistant product manager, molding compounds, in the sales dept. of the Durez Plastics Div., Hooker Chemical Corp., North Tonawanda, N.Y.

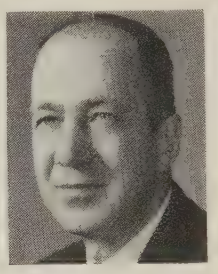
Charles A. Langadeer, formerly with W. L. Maxson Corp., has been appointed chief transformer design engineer for Microtran Co. Inc., Valley Stream, N.Y.

Robert L. Davidson, former vice president and sales manager, has been elected president of Kurz-Kasch Inc., Dayton, Ohio, custom molder of thermosetting plastics.

Arthur E. Thiessen, formerly vice president of the General Radio Co., has been appointed chairman of the board. *Donald B. Sinclair* was promoted from vice president and chief engineer to executive vice president and technical director. *Ivan G. Easton,* formerly engineering manager, was named vice president for engineering, and *Harold M. Wilson,* formerly engineering manager, was appointed vice president for manufacturing.

J. W. Loveland has been named assistant general sales manager of the Electrical Conductor Div., Kaiser Aluminum & Chemical Sales Inc., New York City. *W. W. Hicks* succeeds Loveland as electrical conductor sales manager of the Northeastern region and *J. F. Coleman* has been promoted to assistant sales manager of the region.

J. W. Loveland



W. N. Jackson

Walter N. Jackson, with the company since 1956, has been named plant manager of the Tonawanda, N.Y., plant for Spaulding Fibre Co. Inc., fibre and laminated plastics producer.

Dr. Howard R. Hegbar, since 1946 associated with the engineering organization at Goodyear Aircraft Corp., has been appointed assistant chief engineer.

Kenneth A. Norton, chief of the Radio Propagation Engineering Div. at the Boulder, Colo., laboratories of the National Bureau of Standards, has been named to receive the 1960 Harry Diamond Memorial Award of the Institute of Radio Engineers.

Norman Fischell has been appointed vice president in charge of production by the Circo Equipment Co., Clark, N.J., manufacturer of ultrasonic cleaning equipment.

Norman Fischell

W. E. Benke

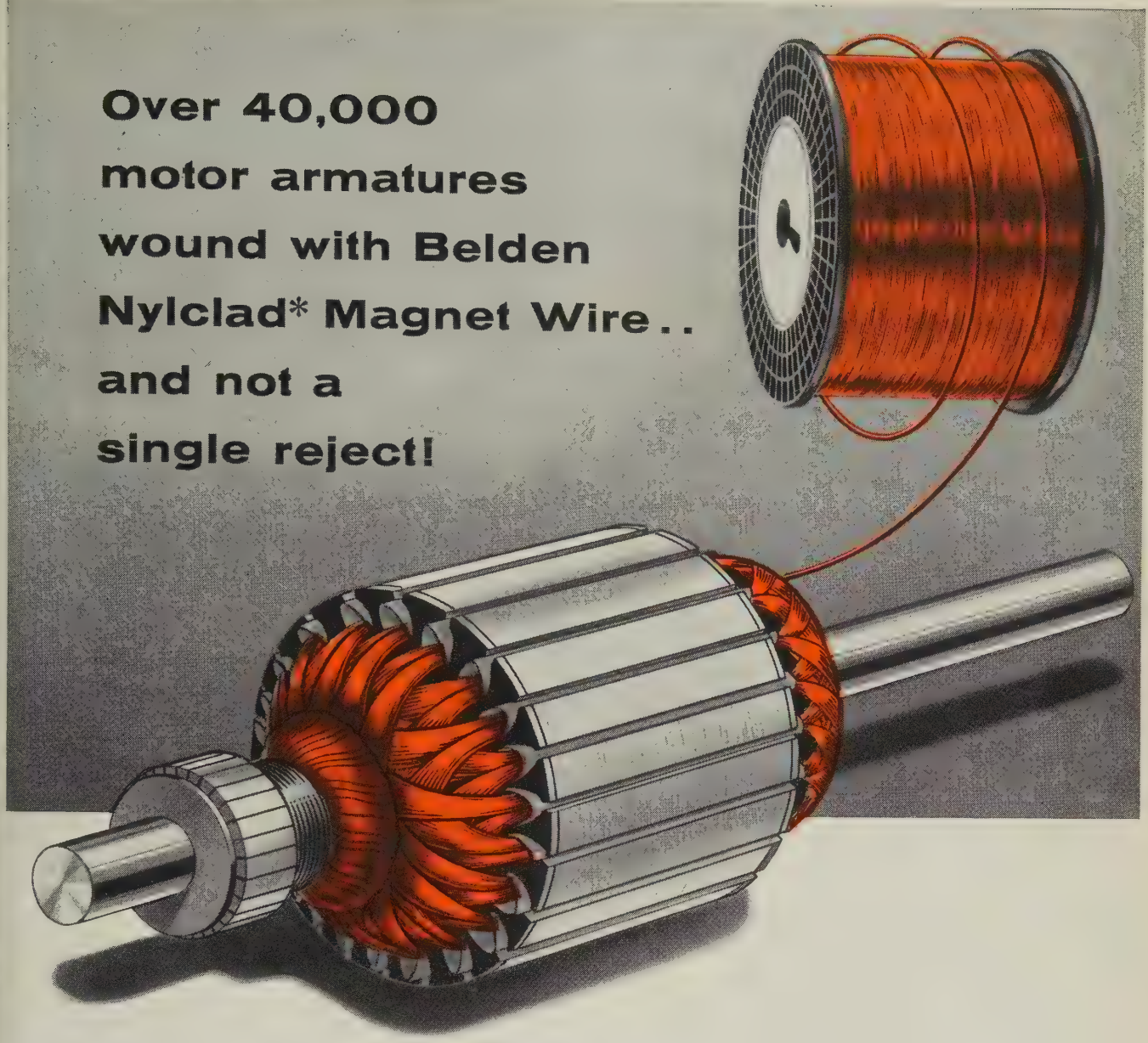
W. E. Benke, vice president, sales, H. I. Thompson Fiber Glass Co., Los Angeles, has been elected to the board of directors. *Sam Brown* has been appointed manager of field engineering. *Don McGuffin* replaces Brown as assistant manager of field engineering. *Robert L. Potter* has joined the sales department of the company.

Lyle A. Trolz has been appointed president and general manager of Mechanical Products Inc., Jackson, Mich., microwave systems manufacturer.

Leo Forth Jr., superintendent of technical service at the Los Angeles plant of the Sherwin-Williams Co., has been named project manager of the company's industrial sales division in Cleveland.

Charles B. Eisenhauer has been named general manager of the Electronics Div. of Van Norman Industries Inc., Manchester, N.H. He formerly was director of manufacturing at Continental-Diamond Fibre Corp.

Over 40,000 motor armatures wound with Belden Nylclad* Magnet Wire.. and not a single reject!



a story that's hard to believe . . but true!

A well-known manufacturer of appliances had excessive trouble with the magnet wire he was using to wind his motor armatures. In an effort to cut down on rejections, he switched to Belden Nylclad Magnet Wire. Result: Not a single rejection out of a 30-day run of over 40,000 armatures. Such a record would not have been possible without a shop using the most modern winding techniques and without operators who take a real pride in their work! Belden Nylclad Magnet Wire is ideal for motor stators and rotors, encapsulated control coils, relays, toroids, and random and deep windings. Nylclad gives the best windability . . has the toughest film coating.

Other Belden Magnet Wire: Beldenamel®, oleoresinous • Beldsol®, polyurethane-Nylon • Beldure®, polyurethane • Celenamel®, Cellulose acetate • Formvar, vinyl acetal • Nylclad®, vinyl acetal-Nylon

*Belden Trademark Reg. U.S. Pat. Off.

Belden
WIREMAKER FOR INDUSTRY
SINCE 1902
CHICAGO

one wire source for everything electrical and electronic

lead wire • power supply cords • cord sets • portable cordage • electronic wire • control cables • automotive replacement wire and cable • aircraft wire

1-2-0

REPORT FROM

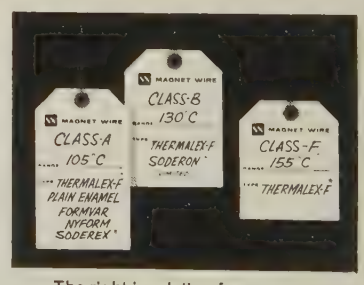
ESSEX MAGNET WIRE LABORATORIES*

*TECHNICAL INFORMATION CENTERS FOR RESEARCH, DEVELOPMENT, VALUE ANALYSIS AND ENGINEERING.

NOW AVAILABLE

Comprehensive Data on Magnet Wire Encapsulation

A series of thermal aging tests were run by Essex Magnet Wire Laboratories to determine the compatibility of a number of magnet wires with encapsulating compounds. This data has been compiled into a test report which can be used as a guide in wire selection. Write for the complete test report or consult your Essex Magnet Wire salesman about the Essex Continuing Magnet Wire Testing Programs.



The right insulation for every application with Essex Magnet Wire

MAGNET WIRE DIVISION ESSEX WIRE CORPORATION, Fort Wayne, Indiana

Manufacturing Plants: Anaheim, Calif.; Fort Wayne, Ind.; and Hillsdale, Michigan

National Network of Warehouses and Sales Offices . . . Call Your Local "Essex Man"

Print Ins. 47 on Reader Service Card

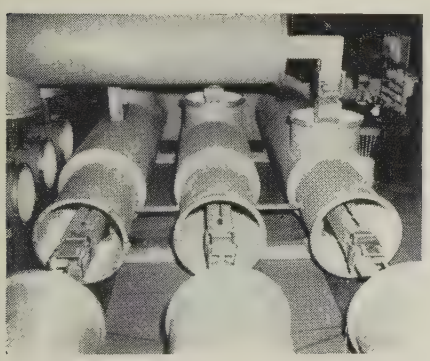
New Prefixes for Units Adopted by NBS

The new prefixes for denoting multiples and sub-multiples of numerical units recommended by the International Committee on Weights and Measures have been adopted by the National Bureau of Standards. In addition to the eight numerical prefixes in common use, the committee expanded the list by adding the four prefixes marked with an asterisk in the table below. Thus, for example, 10^{-12} farad is called 1 picofarad, and is abbreviated 1 pf.

Multiples and Sub-Multiples	*Prefixes*	*Symbols*
1 000 000 000 000=10^{12}	tera*	T
1 000 000 000=10^{9}	giga*	G
1 000 000=10^{6}	mega	M
1 000=10^{3}	kilo	k
100=10^{2}	hecto	h
10=10	deka	dk
0.1=10^{-1}	deci	d
0.01=10^{-2}	centi	c
0.001=10^{-3}	milli	m
0. 000 001=10^{-6}	micro	μ
0.000 000 001=10^{-9}	nano*	n
0.000 000 000 001=10^{-12}	pico*	p

New Bus Design

A new bus design reduces the occurrence of circulating currents that result in generator station power losses. Recently announced by General Electric's High Voltage Switchgear Department, the new bus uses



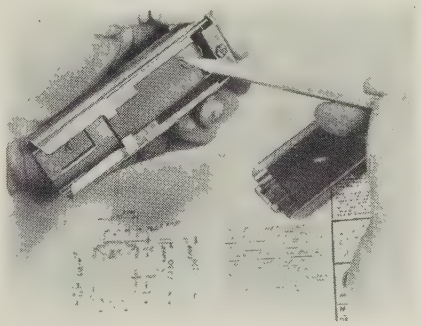
the single-insulator conductor principle introduced by G-E in 1954 and can be self-cooled, forced-air cooled, or furnished for 105° temperature operation. The first equipment of the new bus design will be installed at the Pacific Gas and Electric Company's Pittsburgh Station.

Improved Value For the Faraday

A new determination of the faraday using an electrochemical method which dissolves, rather than deposits, silver in an electrolytic solution was recently made by the National Bureau of Standards. The value thus obtained, 96,516.4±2.0 coulombs (physical scale), depends upon the atomic weight of silver, the standards of mass and time, and the electrical standards as maintained by the Bureau. The faraday is the quantity of electricity associated with a change of one equivalent weight of the reacting substance in any electrolytic process.

Short Circuit Circumventor

This insulating part in the end cap assembly of a "Universal" lighting duct prevents short-circuiting of bus bar duct against the metal cover. It is



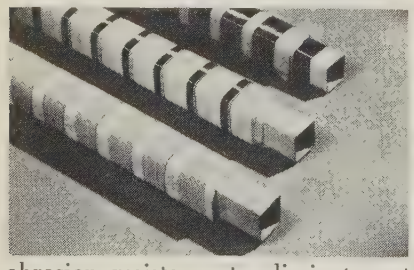
fabricated by Taylor Fibre Co., Norristown, Pa., of "Taylorite" insulation grade vulcanized fibre, 1/32-inch thick, with tolerances of ±.003 inch on thickness. The lighting duct is made by I-T-E Circuit Breaker Co., Detroit.

New Products

For further information on these products print the item number on the Reader Service Inquiry Card on the back cover. Fill out and mail the card—no postage is required. Insulation *will immediately forward your inquiry to the manufacturers concerned so that they can send you more information promptly.*

New Low Cost Insulating Paper for Dry-Type Transformer Coils

A new type of insulating material made of vegetable parchment paper has been developed for use in dry-type transformer coils. The new dielectric, "Patapar" insulating parchment, reportedly has unusual physical and chemical characteristics, and is said to provide exceptionally uniform dielectric strength and good machineability at less cost than other paper materials presently being used. The minimum average dielectric strength of a two-mil sheet is 321 vpm—as compared with 336 vpm for kraft paper, and 308 vpm for glassine paper. Other factors which are said to make Patapar a preferred material for coil winding are: good machineability on automatic or semiautomatic coil winding equipment; an etched surface which firmly anchors the coil wires to the paper and prevents the completed coil stock from telescoping (note tight coil "stick" wound with Patapar at bottom of photo); high



abrasion resistance to eliminate guttering and to prevent the wire from wearing through the paper; good resistance to class A temperatures (up to 105°C); uniform tensile strength in both machine and cross direction; permanent wet strength so that the paper will accept encapsulating resins without losing insulating properties; and an extremely low ash content proving purity. Brochure available. Paterson Parchment Paper Co., Bristol, Pa.

Print No. Ins. 101 on Reader Service Card

"Teflon"-Glass Electrical Laminate Resists 250°C, Chemicals

A new Teflon-glass laminate that is highly resistant to chemical attack is also said to have excellent electrical properties, outstanding resistance to mechanical abuse, and low cold flow under heat and pressure. The new, high temperature laminate, called No. 6098 "Lamicoid," is manufactured from Teflon resin and a fine weave, 0.002 glass fabric. It reportedly combines the outstanding chemical and electrical properties of Teflon and the physical and mechanical properties of the glass cloth. The fine weave of the glass used is stated to allow even distribution of the Teflon resin throughout the laminate, thus insuring very uniform electrical and physical properties, including thickness and surface finish. Properties claimed include 250°C continuous heat resistance, 185 seconds arc resistance, and 2.68 dielectric constant at 1 mc. These laminates, with 1 or 2 oz. copper foil bonded to one or both sides, are claimed to be ideal for high temperature (200°C) printed circuits and microwave applications. No. 6098 Lamicoid is made in standard 17" x 37" sheets in thicknesses from 0.006" to 0.250" which are reported to meet the requirements of MIL-P-19161A. Prices range from $25.65 per sheet at 0.006" thick to $241.62 per ¼" sheet. Mica Insulator Div., Minnesota Mining and Manufacturing Co., Schenectady 1, N.Y.

Print No. Ins. 102 on Reader Service Card

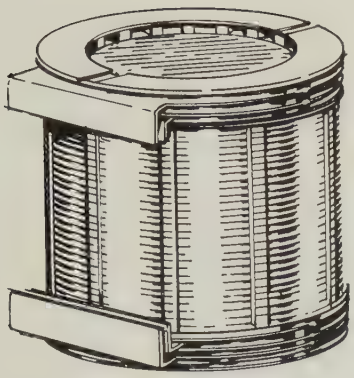
New Heat Stable Resin for Coatings, Film, Sheets, Tubes, and Moldings

A new fluorine-containing thermoplastic resin, RC-2525 resin, is said to provide advantages for a wide variety of applications in such industries as aircraft and missiles, automotive, electrical, and electronics. RC-2525 resin reportedly can be used in coatings for wire, and in sheet and film forms for other insulation applications. A high degree of thermal stability; high resistance to heat, light, solvents, and chemicals; superior mechanical strength and toughness; stability under strong ultraviolet radiation and extreme weather conditions; easy fabrication, high impact resistance; nonshattering at low temperatures; and flexibility and long life in environments which degrade less stable materials are among the advantages cited. It can be fabricated into intricate shapes, sheets, rods, and tubes by compression molding, injection molding, and extrusion. Dispersions of the resin can be applied by spray coating and casting techniques to form thin protective coatings. It laminates to wood, metal, and other plastics. Chemically, RC-2525 resin is a crystalline high molecular weight polymer of vinylidene fluoride. It contains over 59% fluorine by weight. Its properties are strongly influenced by the stability and inertness characteristic of highly fluorinated hydrocarbon structures. Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia 2.

Print No. Ins. 103 on Reader Service Card

New Flame-Resistant Epoxy

A new flame-resistant epoxy, #1202, is claimed to be excellent for applications in computers, and for use in the "E-Pak" encapsulation system for electronic components. The properties of Epoxy #1202 reportedly include: extinguishing time of 0-1 second; thermal conductivity (cal/sec/cm^2/c/cm) of 9.2 x 10^{-4}; water absorption (24 hrs) of .04%; weight loss (24 hrs at 150°C) of .26; dielectric constant (1 meg.) of 5.6; dissipation factor (1 meg.) of .028; volume resistivity of 1.3 x 10^{15} at 25°C and 3.1 x 10^{10} at 150°C; and insulation resistance (96 hrs at 90% RH and 95°F) of 9 x 10^{10}. E-Cases of molded epoxy #1202 are stated to have been successfully tested for 1000 hrs at 200°C as packages for electronic components. Photo shows new material on left and conventional epoxy on right. The material is available in several



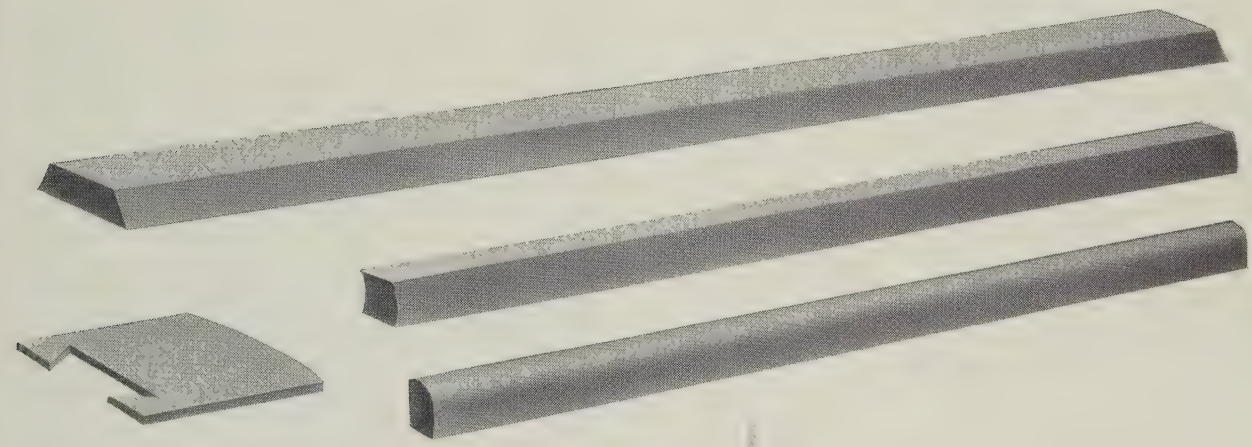
SPAULDING TK TRANSFORMER SPACERS

CLOSE THE GAP BETWEEN DESIGN and PRODUCTION

Longer transformer life, bigger load capacities, higher operating temperatures . . . these are some of the characteristics that are possible individually or in certain combinations with Spaulding transformer spacers and boards.

As in other fields, Spaulding Research in transformer insulation helps the engineer convert imaginative design into practical application.

Complete data on Spaulding transformer insulation, as well as Progress Reports on other Spaulding applications for industry, are available on request.



Characteristics of

SPAULDING TRANSFORMER INSULATION

- Higher operating temperatures, with no loss of dielectric strength.
- Low compressibility — high dimensional stability.
- Unaffected by transformer oils.
- Permits tighter coil windings, prevents coil slippage.
- Fabricated to exact specifications, no waste, greater economy.

SPAULDING FIBRE COMPANY, INC. 353 WHEELER STREET TONAWANDA, NEW YORK

In Canada: Spaulding Fibre of Canada, Ltd. • 70 Coronet Rd., Toronto 18, Ont.

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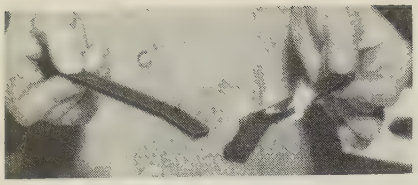


compatible forms, including molded cylindrical and square shells, custom-molded components, and liquid epoxy resin. A pellet is under development. Epoxy Products, 137 Coit St., Irvington, N.J.

Print No. Ins. 104 on Reader Service Card

New Fluorosilicone Sponge Rubber

A new fluorosilicone sponge rubber dielectric compound with a dense, uniform, nonabsorbing closed cell structure, "COHRlastic" 10530, is said to provide outstanding resistance to fuels and lubricants at extreme high temperatures. Immunity to aging, ozone, and weather hardening, excellent dielectric properties, and good compression set resistance are also claimed. Laboratory tests reportedly show that COHRlastic 10530 has superior resistance to fuels and oils such as Reference Fuel B, MIL-S-3136 type III and MIL-L-7808C oil. The material is said to have little change in physical properties over a temperature range of from —100°F to 500°F. Molded sheets 12″ x 12″ and 24″ x 24″ in ⅛″, 3/16″, and ¼″ thicknesses are available. One-eighth inch material is priced at $14 per sq. ft. The Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.

Print No. Ins. 105 on Reader Service Card

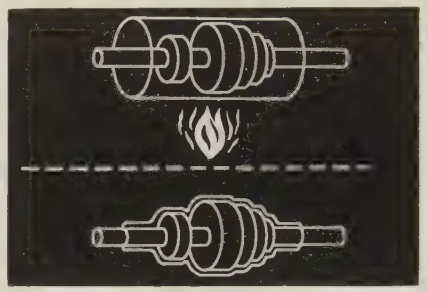
Continuous Length Epoxy-Glass "Mylar" Laminates in Sheet and Roll

New continuously manufactured thin epoxy fiber glass reinforced laminates wtih Mylar faces are said to possess excellent physical and electrical characteristics. Widths of up to 48″ in cut-to-size sheets or continuous length rolls are available in thicknesses ranging from .006″ to .060″. Electrical and corrosion resistant properties combined with good physical strength, excellent fungus resistance, and flame retardance are claimed. Swedlow Inc., 6986 Bandini Blvd., Los Angeles 22.

Print No. Ins. 106 on Reader Service Card

Expanded "Teflon" Tubing Shrinks To Form a Tight Fit

Thin and standard wall Teflon-TFE tubing that has been expanded mechanically reportedly will recover the original dimensions promptly and cling tightly to the inserted object when heat is applied. The electrical, mechanical, and chemical properties of Teflon are retained. The tubing, which can be obtained in 11 basic colors, printed, and cut to required lengths, has many uses including encasing irregular shapes and protecting electrical components such as wire connectors, terminals, semiconductors, etc. The tubing can be made cementa-

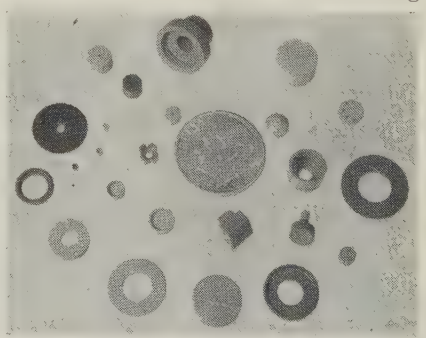


ble. Properties cited include dielectric strength of 500 to 1000 vpm; low dielectric constant of 2.0, dissipation factor of 0.0002, and no change of electric properties with temperature (—25°C to +250°C). Pennsylvania Fluorocarbon Co. Inc., 1115 N. 38th St., Philadelphia 4.

Print No. Ins. 107 on Reader Service Card

Microminiature Fluoropolymer Parts

A new series of compounds using a wide range of elastomeric materials have been developed for specialized electronic applications. These materials have been compounded with special emphasis on their electrical properties, chemical resistance, and high temperature service. All materials are said to be free of carbon and sulfur to permit use in thin insulating and gasketing applications without risking



current leakage, silver tarnish, or outgassing. Special techniques have been developed for handling fluoropolymers such as "Kel F" elastomer and "Viton," and for mass production of microminiature rubber parts. Industrial Electronic Rubber Co., 31945 Aurora Rd., Solon, Ohio.

Print No. Ins. 108 on Reader Service Card

New Flexible Insulating Materials Formed of Plastics Fibers and Resins

A new class of flexible electrical insulating materials is formed of plastics fibers with compatible plastics resins. Higher dielectric strength per unit of thickness than existing types of fibrous sheet insulating materials plus retention of the mechanical strength of existing products is claimed. Composed of acrylic ("Orlon") fiber in combination with acrylic resin, the first of the new materials, Duroid 2100, is primarily intended for hermetic applications where a primary consideration is resistance to Freon-oil mixtures. It was developed to meet product design trends calling for lighter, less bulky but more protective electrical insulation. Rogers Corp., Rogers, Conn.

Print No. Ins. 109 on Reader Service Card

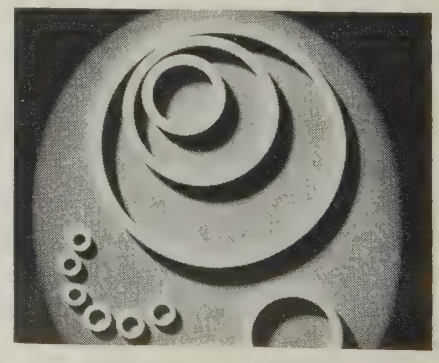
Thin, High Dielectric "Teflon" Tape

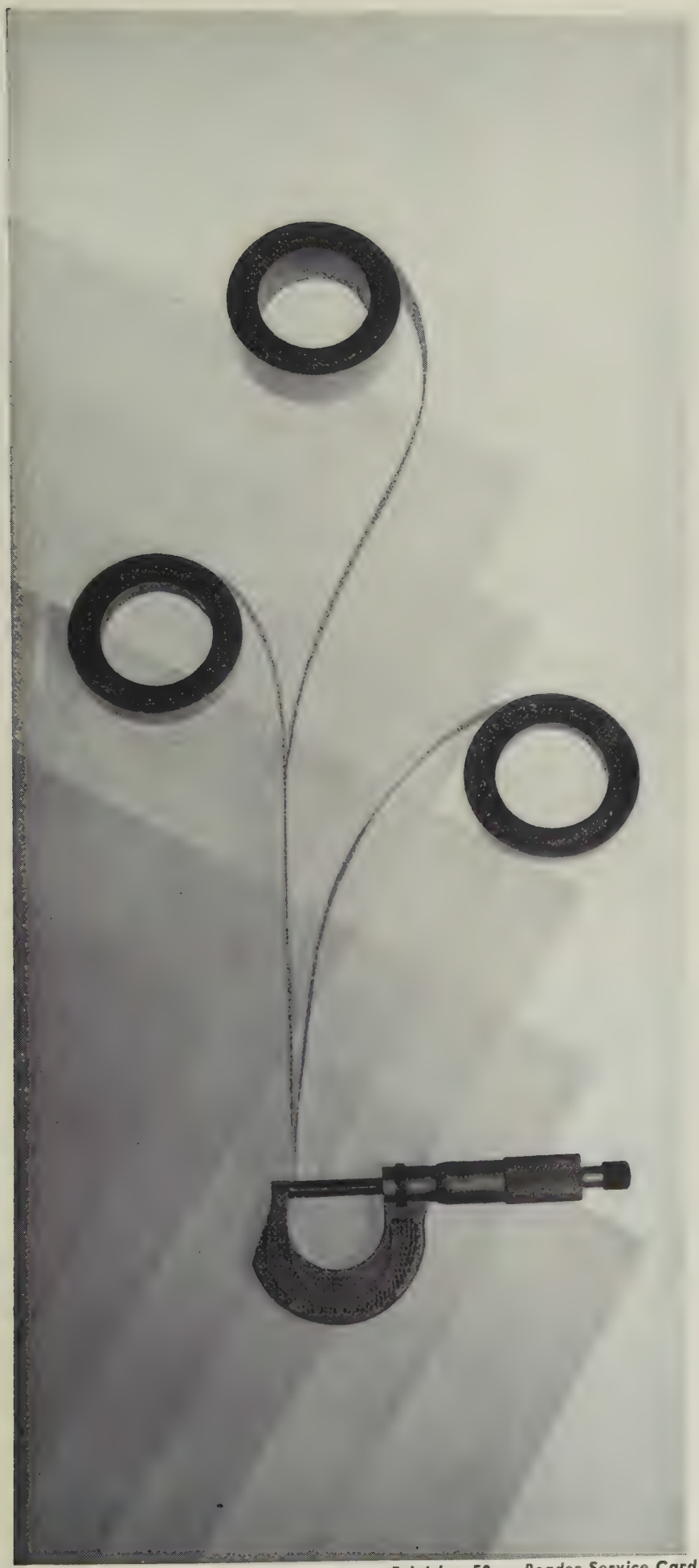
A 1-mil skived Teflon (TFE resin) tape for wire insulation is stated to be of particular value for use on thermocouple wire and other constructions where cable size and weight must be minimized. Tape is furnished in widths from ⅜″ to 12″. Because of its high dielectric strength (3800-4200 v), it reportedly can be used in multiple layers in place of fewer layers of thicker tape with pronounced performance advantages and overall savings in insulation thickness. Tensile strength is 3000 psi minimum and elongation is 250% minimum. Low shrinkage, (no more than 2% after 15 minutes at 730°F, is also claimed. Plastics Div. Dixon Corp., Bristol, R.I.

Print No. Ins. 110 on Reader Service Card

New Line of "Teflon" Rings

A new line of Teflon TFE-fluoro-





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by

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Today's design, production and service requirements call for electrical insulation materials of increased endurance — with higher dielectric values and greater physical stability. That is why it is more important than ever to use *customized* insulation in your product — insulation that is tailored to meet your specific requirements.

Electro-Tech has long been a leader in *customized* insulation materials for the development and construction of compatible electrical insulation systems. This leadership is based on the field-proven efficiency of such Electro products as Glas-Bes, Cyno-Glas, Dac-Var and others. It continues to grow with new products such as Sil-Bestos — a combination of silicone treated glass cloth with purified asbestos paper which is extremely suitable for layer insulation in transformers and slot cell insulation in rotating equipment.

For your *customized* insulation requirements call or write:

Electro-Technical Products

DIVISION

Sun Chemical Corporation

113 East Centre Street,
Nutley 10, N. J.

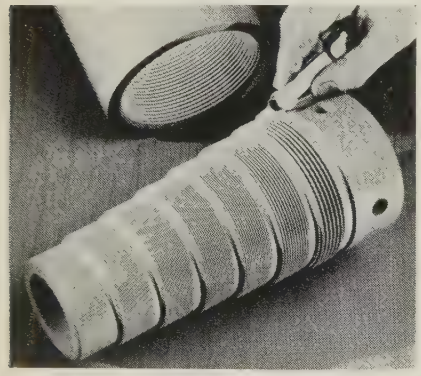
Print Ins. 50 on Reader Service Card

carbon O-rings provides approximately 300 standard sizes. Complete chemical inertness, high heat resistance, and excellent sealing ability are claimed. The new uniform dash-numbering system for O-rings known as ARP-568, recently adopted by the Society of Automotive Engineers, is used to identify the O-rings. Chicago Gasket Co.. 1271 W. North Ave., Chicago 22.

Print No. Ins. 111 on Reader Service Card

New Thick-Wall Laminated Tubing For Electrical Components

New thick-walled, paper-based "Micarta" tubing is designed for electrical applications such as lightning arrester barriers and fuse tubes, in which high strength, good electrical properties, freedom from cracking, and resistance to moisture are necessary. For such uses it is said to be equivalent in performance to cloth-based materials. Grade 20005 tubing is guaranteed to be crack-free in wall thicknesses up to 1″. Readily machined with conventional equipment,



it can be tapped or threaded with as many as 28 threads per inch. The new material reportedly conforms to performance requirements specified for molded tubing of NEMA grade XXX and MIL-P-79B type PBE. Moisture absorption is less than 1%, compressive strength is 21,000 psi, and tensile strength is 12,000 psi. Short-time dielectric strength is 500 vpm, and dissipation factor is 0.045 at one megacycle. Micarta Div., Westinghouse Electric Corp., Hampton, S.C.

Print No. Ins. 112 on Reader Service Card

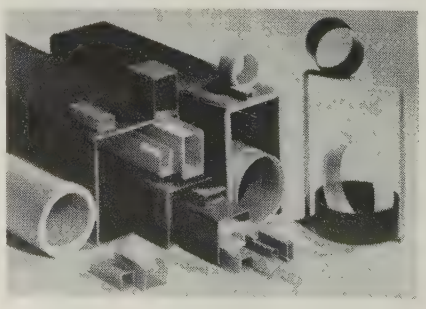
Fluoro Elastomer Insulation Resists 200°C, Corrosive Chemicals

New fluoro elastomer components for electronic, missile, and automotive applications reportedly exhibit excellent dielectric properties, resist high temperatures, and are impervious to corrosion. Processing "Kel-F" brand halofluorocarbon elastomer 3700 with a special peroxide cure is stated to have increased the temperature performance maximum from 85°C to 200°C without reducing resistance qualities. One application suggested is for high temperature electric insulation. It has been used in subminiature electrolytic capacitors that will withstand temperatures as high as 200°C during exposure to 40% sulfuric acid. Thermal stability of the fluoro elastomer is afforded by the high fluorine content (50% by weight) in the gum compound. In addition, the elastomer's resiliency and dimensional stability are said to have provided a permanent hermetic seal even when the capacitor reached high temperatures and was carrying high electrical loads—with no seal oxidization at the extreme temperatures. In a porous tantalum capacitor potting application the elastomer is also reported to have provided absolute sealing and insulating qualities. Adaptable to molding and extrusion of even the smallest components, the synthetic may be processed on conventional equipment. Vernay Laboratories Inc., Yellow Springs, Ohio, and Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

Print No. Ins. 113 on Reader Service Card

Transformer Core Tubing of Glass-Phenolic Material

The addition of glass-phenolic "Plaskon" material provides a choice of six materials for core tubing from a stock of over 700 arbor sizes. The other materials are glass-silicone for class H; glass-polyester, melamine, and epoxy for class B; and paper-phenolic for class A. The tubing is said to be precision-made and available in thicknesses from .020″ with ±.005″ tolerance; and +.005″ —.000″ on the ID. Short lengths are used for cases in encapsulation. Stevens Tubing Corp., 86-88 Main St., East Orange, N.J.



Print No. Ins. 114 on Reader Service Card

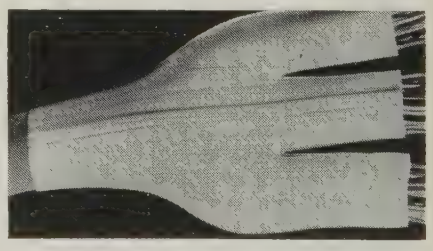
New Silicone Rubber Tape

One side of new Permacel ES 5111 silicone tape, a glass cloth coated with silicone rubber, is fully cured while the other side is uncured. This is claimed to permit an unusually stable and long shelf life. The tape is designed to give armor tape protection when winding motor coils for low or high voltage units. When used with Permacel PSR 2800 triangular guide line tape, it reportedly produces a tough silicone insulation envelope. Use of the ES 5111 tape on coils for rotating machinery is said to provide a void-free envelope without resorting to combinations of heat and pressure. Special equipment is not required to process the tape. Permacel, New Brunswick, N.J.

Print No. Ins. 115 on Reader Service Card

Protective Coverings for Cable Branch-Outs

New "Protechtor" coverings for cable break-outs, branch-outs, and splices are available in a full range of sizes and a variety of colors. Colors of present cable jackets can be matched. Covers may be ordered with two or more legs, and conventional "T," "Y," and fork designs are avail-

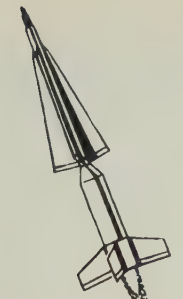


able for distribution cable branch-outs. Use of Protechtors is said to eliminate the need for costly molding and to permit protective covering for branch-outs and splices to be provided quickly and economically in the plant. The Zippertubing Co., 752 S. San Pedro St., Los Angeles 14.

Print No. Ins. 116 on Reader Service Card

Weight-Saving Clamps and Harness Ties for Extreme G-Loads

Lightweight, self-locking "Cab-L-Tite" clamps and "Bund-L-Tite" straps are said to secure wire bun-

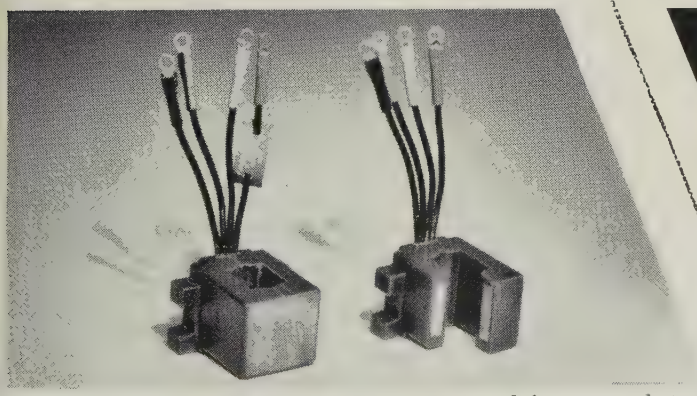


GLASS FIBER LAMINATED WITH "BAKELITE" EPOXY RESIN

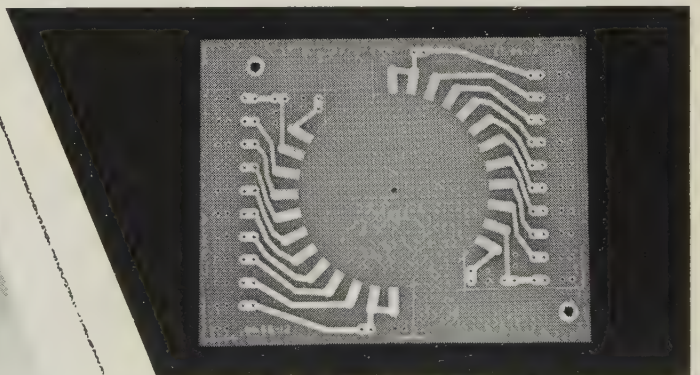
gives printed circuits extra strength, plus heat and humidity resistance

Printed circuits in missiles and rockets must have more than ordinary resistance to temperature and moisture variations and mechanical shock. For the stability required in such critical applications, specify glass fiber circuit boards laminated with a BAKELITE epoxy resin. As a printed circuit base, this combination provides excellent mechanical and electrical properties.

The extra strength and outstanding electrical properties of epoxy-glass fiber laminates make them ideal in the production of high-quality printed circuit assemblies, for civilian as well as military applications. For more information on BAKELITE epoxy resins, write Dept. AL-75, Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York.



BAKELITE epoxy compounds are also widely used for encapsulating electrical components. The low viscosity of the uncured resin assures complete penetration into the tiniest crevices, providing optimum electrical insulation.

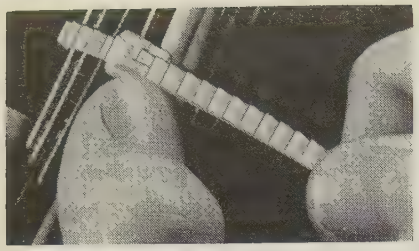


Typical printed circuit board, shown here, is made of glass fiber laminated with BAKELITE epoxy resin. The copper clad laminate is made by Synthane Corporation, Oaks, Pa., for a military application.

UNION CARBIDE

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

Print Ins. 51 on Reader Service Card



dles instantly and to hold securely under extreme G-loads. To fasten clamp, the assembler simply loads wires between U-shaped horns and pushes down a keeper, which can be adjusted for different size bundles. A clamp securing 8,750,000 mils is claimed to weigh only 0.052 lbs. and to withstand 50G's. Bund-L-Tite is a detented strap reported to lock with positive holding power and to be fully adjustable within its own length. The strap is merely pulled to the desired tension and the excess length trimmed off. Both clamp and strap are made of nylon. Inert to solvents and nonnutrient to fungi, the clamp moldings also reportedly meet requirements of MIL-P-17091. Dakota Engineering Inc., 4315 Sepulveda Blvd., Culver City, Cal.

Print No. Ins. 117 on Reader Service Card

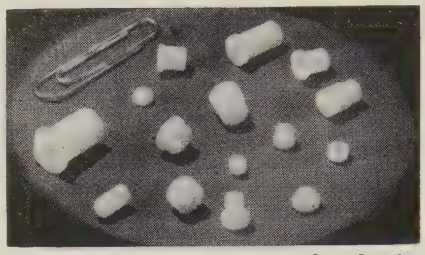
New Wire Wrapping Tape With High Abrasion Resistance

A new wrapping tape known as "Rulon" Abrasion Barrier is now being offered for TFE insulated wires rated for 500°F and higher. This tape, a skived form of Rulon (reinforced TFE resin), is available in thicknesses from 0.004″ up and in widths from ¼″ to 12″. The tape is recommended where extra abrasion resistance is required without increase in usually specified wire diameters. Best results are obtained with a "Teflon" primary insulation, the Rulon tape on top of the primary, and an outer layer of braided fiber glass impregnated with Teflon. After heat aging 96 hours at 750°F, the abrasion resistance reportedly is increased by 20% and the dielectric strength by 1200 v. The Rulon tape also appears to increase flame resistance and decrease the evaporation of primary insulation. Dixon Corp., Bristol, R.I.

Print No. Ins. 118 on Reader Service Card

"Teflon" Insulating Bushings

New Teflon bushings for through-hole wiring reportedly provide complete mechanical and electrical protection for the wire. For insulated wires in assemblies operating under high ambient vibration, the "Press-Fit" bushing is said to provide protection against abrasion of the insulation. The bushing also provides elec-



trical protection for uninsulated wiring passing through a metal chassis. Sealectro Corp., 610 Fayette Ave., Mamaroneck, N.Y.

Print No. Ins. 119 on Reader Service Card

New Fiber Glass Insulation For Taping, Bonding, and Tying

A new impregnated woven fiber glass cloth for use as an electrical insulating material is described as having high physical strength in relation to its weight, excellent dimensional stability, exceptional tensile strength, low elongation, good dielectric properties, and high resistance to solvents and chemicals. The product is designed essentially to replace varnish-impregnated cotton tapes. Identified as Acto-Glas Mark II, it is supplied in a partially cured stage. When subjected to heat, pressure, and time cycles, it becomes a fully-cured homogenous material in the nature of a laminate. Applications include insulation of coils and armatures in rotating equipment, transformer coil insulation, as random tying tape during the making-up of transformer coils, and as a banding tape for armatures. Electrical coils can be taped with normal tensions, yet because of the thermosetting properties of the impregnated cloth, it shrinks during the curing operation to become extremely secure and snug-fitting around the coil. The cloth is tacky in

its partially cured form, and during the taping each successive layer adheres to itself. The impregnated cloth is currently being produced with a B stage polyester resin Mark III or with an epoxy resin. The temperature class of the polyester is 130°C and that of the epoxy is in excess of 150°C. Curing time cycle for polyester impregnated cloth is 3 to 15 minutes at 250° to 300°F. Electro-Technical Products Div., Sun Chemical Corp., 113 East Centre St., Nutley 10, N.J.

Print No. Ins. 120 on Reader Service Card

Rubber Sheet Resists Strong Fluids at High Temperatures

A new rubber sheet stock, COHR-lastic 975 "Viton" sheet, is said to have increased resistance to strong fluids at extreme high temperatures and a remarkable extension of service life. Aircraft and missile parts and automotive applications are but a few of the many areas in which the 75 durometer stock can be used. Outstanding resistance to such materials as carbon tetrachloride, benzene, most mineral acids, and to fuels, oils, and lubricants used in missiles and high-speed aircraft (such as JP-4 fuel, MIL-O-5606 oils, MIL-L-7808 diester lubricants, and silicone oil lubricants) is claimed. Heat aging tests at temperatures in the 500°F to 600°F range reportedly show a better elongation retention and less hardness change than previously possible with any commercial elastomer. The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.

Print No. Ins. 121 on Reader Service Card

Metalized Ceramic Resistor Housings

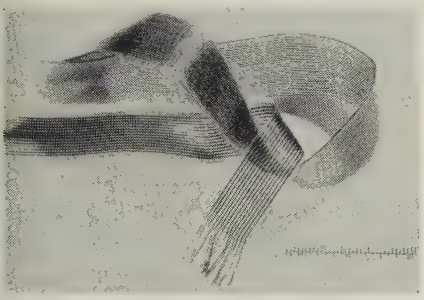
A complete line of metalized ceramic housings for carbon-fixed. wire-wound, and film-type resistors is now available in both steatite and alumina ceramics in a wide range of sizes. The metalized housing features a metallic band approximately 3/16″ wide on each of the inner ends of a tubular ceramic shell. The metallic band is a silver fired coating which has been hot-tin coated for easy soldering. An exceptionally long "burn time" (ability to maintain bond to the ceramic at 200°C) is claimed. In the photo, letter "a" shows typical metalized ceramic resistor housings; letter "b" shows a cut-away component; and letter "c"

shows the finished resistor solder-sealed into the metalized ceramic shell. Metalizing Industries Inc., 338 Hudson St., Hackensack, N.J.

Print No. Ins. 122 on Reader Service Card

Flexible Subminiature Cable For —320°F to +600°F

An extremely flexible subminiature multiconductor cable for missile, computer, and strain gage applications, "Super-Flex" cable, is designed for use where extreme temperature ranges are encountered (—320°F to +600°F) and where movement or vibration precludes the use of other types of materials. Cables, with connectors, can be fabricated in lengths up to 9 ft. and widths are determined

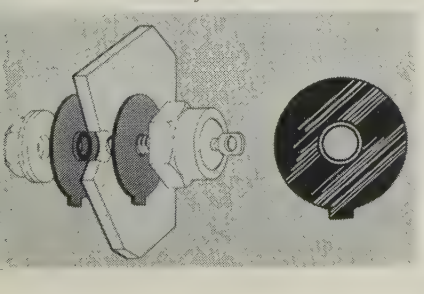


by the size and number of conductors. The stranded conductors are spaced and molded in a special material. Extreme flexibility is said to be achieved without sacrifice of tensile strength. Cicoil Corp., 13833 Saticoy St., Van Nuys, Cal.

Print No. Ins. 123 on Reader Service Card

Insulator Wafers for Diodes

Hard-anodized insulator wafers for stud-mounted diodes reportedly provide outstanding dielectric insulation and thermal conductivity. They can be installed between diode and chassis and between hex jam nut and chassis.

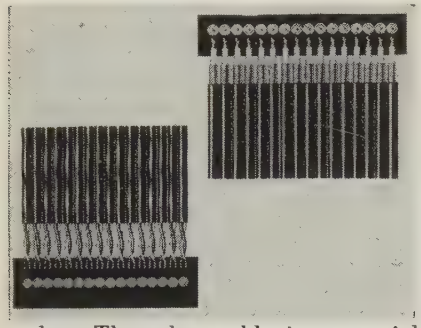


The extruded center hole insulates the stud from the chassis and eliminates the necesssity for a separate insulating bushing. Wafers designed for use with semiconductors of other configurations are also available. Monadnock Mills, a subsidiary of United-Carr Fastener Corp., San Leandro, Cal.

Print No. Ins. 124 on Reader Service Card

Two New Bonded Cable Constructions

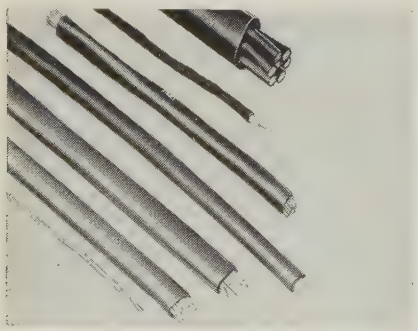
Two new thermoplastic insulated cable constructions are specifically designed for use in the communications and electronics industries. One cable consists of 16 individually jacketed pairs of color-coded conductors laid parallel to each other and bonded together. The other cable is a coaxial construction, with 16 conductors individually insulated with "Rulan," shielded, vinyl-jacketed, and joined together in flat bonded cable form. Phalo Plastics Corp., Shrewsbury, Mass.



Print No. Ins. 125 on Reader Service Card

Complexed Multiconductor Cables In Short Lengths

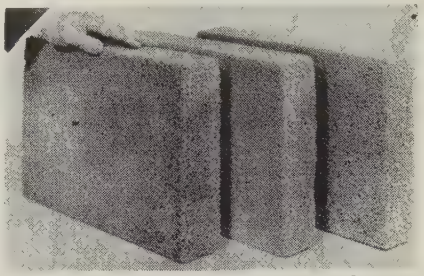
A new manufacturing technique reportedly enables short lengths of various types of multiconductor neoprene-jacketed cables to be economically fabricated from various types and sizes of insulated conductors. Excellent performance characteristics even when subjected to severe conditioning are claimed. Cable Designs Inc., Dept. A-3, 66 Rushmore St., Westbury, N.Y.



Print No. Ins. 126 on Reader Service Card

Quartz Foam for 2500°F

A new low loss, low-dielectric ceramic foam for 2500°F use, designated "Eccofoam" Q, is essentially pure silicon dioxide with a unicellular foam structure. Weight is approximately 12 lbs/cu ft. The dielectric constant at microwave frequencies is 1.2 and the dissipation factor is below 0.001. Emerson & Cuming Inc., 869 Washington St., Canton, Mass.



Print No. Ins. 127 on Reader Service Card

Handy Electric Melting Pot

Convenience and economy in the melting of many materials are said to be provided by an "Electro" lead pot and furnace. The fully insulated one-piece unit is made in 25, 45, and 75 lb capacities, with a temperature range from 600° to 1000°. The electric units are sold on a money-back guarantee. Literature available. Maurice Fetterman Co., 1170 Broadway, New York 1.

Print No. Ins. 128 on Reader Service Card

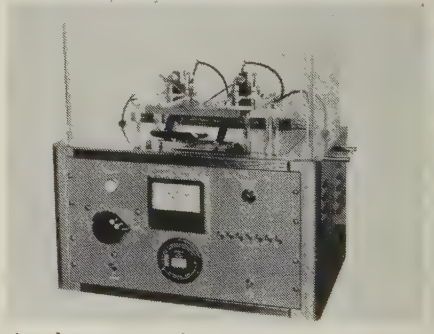
New Wire Package Facilitates Handling

New wire packaging method consists of a tapered barrel spool in a shipping container which operates with supplementary equipment called a De-Paker. The De-Paker acts as a tensioning and control device for high-speed payoff by the customer. The outer container is extremely strong, resisting dents, and at the same time is water-resistant. The Hud-Pak De-Paker reportedly permits virtually unlimited speed of pull-out without the use of dampening devices. Rates of acceleration and deceleration are practically unlimited, due to the lack of inertia encountered with revolving reels. The package may be used on any wire size, bare, plated, or insulated, from 14 AWG to 38 AWG. The Hud-Pak contains from 100 to 120 lbs of wire, but may be furnished with less upon special order. A second size will be available shortly carrying an average of 35 lbs of finer wire sizes. Hudson Wire Co., Ossining, N.Y.

Print No. Ins. 129 on Reader Service Card

Arc-Resistance Tester for Solid Electrical Insulating Materials

Model 8540 arc resistance tester is a compact bench-type instrument suited for both laboratory and production quality control applications. This instrument provides 15 kv at 60 ma a-c for testing the ability of solid electrical insulating materials to resist the action of an arc in accordance with ASTM Specification D-495 and Federal Specification LP406B. Compliance with the specifications reportedly is accomplished by a voltage control that is continuously variable from 0 to 15,000 v, an internal blower for cooling and venting toxic gases, a voltmeter with suppressed zero to accurately meter the primary potential between 90 to 130 v, seven arc control switches to adjust the severity and

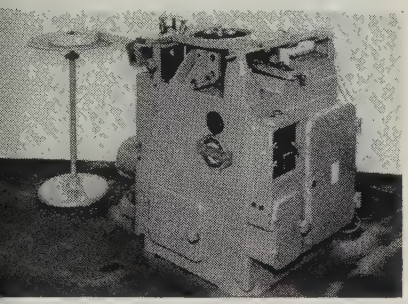


ycling of the arc, an interval timer or timing the total test application of ne arc to the nearest one-tenth second, and a transparent protective cage ith safety interlock. Associated Research Inc., 3777 W. Belmont Ave., hicago 18.

int No. Ins. 130 on Reader Service Card

lot Inserter Handles Different ypes and Sizes of Stators, Rotors

The "Statomat" E1U is a new machine that forms and inserts round r square shaped motor slot insulators of "Mylar" and paper-Mylar ombinations. It can handle different ypes and sizes of stators and rotors. he machine can accommodate stack eights up to 5½" and OD's up to 0". Other features claimed include

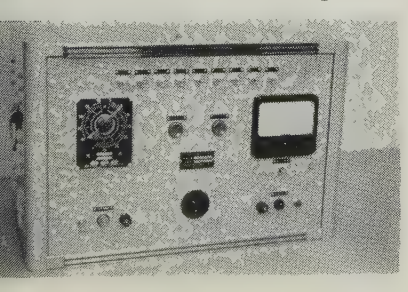


omplete changeover of tools for different types and sizes of stators in bout 15 minutes, with only approximately 5 minutes required for change o a different stack height. Capacity less than ½-second per slot. Erinac quipment Corp., 225 Lafayette St., lew York 12.

int No. Ins. 131 on Reader Service Card

utomatic Dielectric Tester or Multiconductor Devices

A new automatic test set is designed for dielectric testing of cables, eaders, switches, slip-ring assemblies, and other multiconductor devices. Features reported include any umber of test positions to order, oltage continuously adjustable up to kv rms, test duration or dwell time djustable from 1 to 120 seconds, and aximum short circuit current limited 5 ma. The built-in test cage with

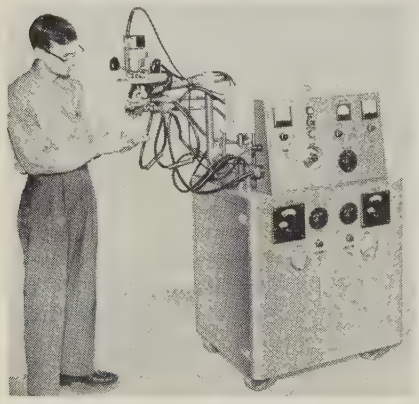


terminal board for components is accessible through the top lid of the cabinet. Other automatic test sets are available with additional functions, such as continuity and insulation resistance in addition to dielectric testing. Peschel Electronics Inc., Towners, Patterson, N.Y.

Print No. Ins. 132 on Reader Service Card

Miniature Model Polyurethane Foam Producing Equipment

A miniature model small-shot production unit can pump, meter, and mix two-component formulations for rigid, semirigid, or flexible polyurethane forms. The throughput is variable from zero to two lbs per min. With the self-cleaning, on-off mixing device, shots of mixed materials reportedly can be accurately proportioned, dispensed, and reproduced in quantities of a few grams to continuous pours. The 33″ x 26″ x 52″ self-

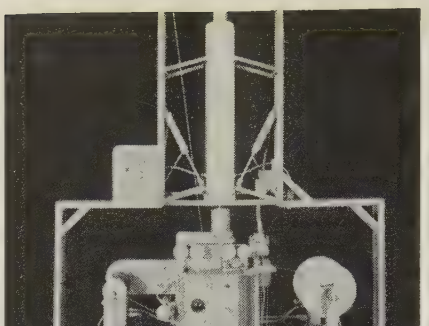


contained unit includes component tanks, temperature controlling heat exchangers and heated delivery hoses, individual throughput control of materials by positive-type variable drives and rotary pumps, and mixing head and foam cycle controls. The Martin Sweets Co. Inc., 114 S. First St., Louisville 2, Ky.

Print No. Ins. 133 on Reader Service Card

New Machine for Continuous Three-Color Spiral Wire Striping

A high production, fully automatic spiral wire striping machine will color code nylon and PVC jacketed wire with 1, 2, and 3 stripes at one time on wire from .050 to 5/16″. This model 1-S reportedly stripes at speeds up to 150 ft/min through its variable speed control. Its quick change-over from one wire type, size, and color combination to another can help reduce the wire inventory usually carried when

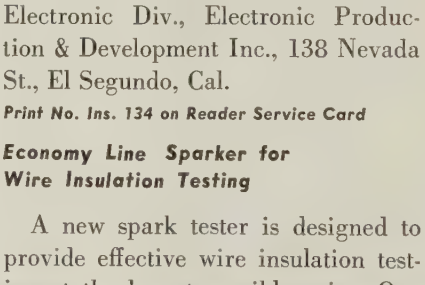


wire is striped by the manufacturer and has to be carried in stock. After the wire is striped, the ink is dried by passing up through a 7 ft vertical high heat drying tower equipped with an indicating type heat controller which may be varied from 100° to 600°F. To prevent wire damage (or burning) when the machine has been shut off manually, or through the safety switches, the split-type heating tower opens automatically and the heating elements move away from the wire approximately 6″ as the heating element current is shut off. The three-color inking head is easily accessible for cleaning and filling and for making color changes. Each section of the ink reservoir can be independently adjusted to insure positive wire contact and to eliminate striping breaks. Many other outstanding features are claimed. Catalog sheets available. Electronic Div., Electronic Production & Development Inc., 138 Nevada St., El Segundo, Cal.

Print No. Ins. 134 on Reader Service Card

Economy Line Sparker for Wire Insulation Testing

A new spark tester is designed to provide effective wire insulation testing at the lowest possible price. One



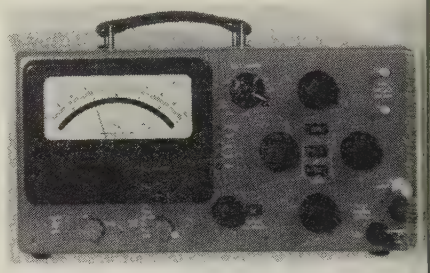
of a series of units to be sold under a new "Economy Line," the sparker incorporates both the 10 ma controlled power testing circuit and the electronic fault detection circuit which are featured in the higher-priced National and Imperial models. Units are

available in the following ranges: 1-
kv; 1.5-7.5 kv; 2-10 kv; and 3-15 kv
Enjaco Corp., Box 3674, Cranston 10
R.I.

Print No. Ins. 135 on Reader Service Card

New D-C Incremental Voltmeter

A new battery-powered incrementa
voltmeter, Model 130, designed fo
the precision measurement of d-c volt
ages, reportedly incorporates an off
set voltage source variable from 0 t
509 v and accurate to 0.1%. Utilizin
this source and the instrument's hig

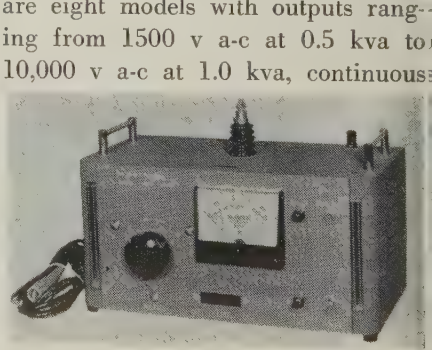


input resistance increment readin
meter, d-c voltages over the range 1
mv through 500 v may be read wit
an error of indication not exceedin
0.2% it is claimed. The unit meas
ures 13″ wide x 7½″ high x 6⅛″
deep. Operating weight with batteries
is 11 lbs. Price is $625. Belleville-
Hexem Corp., 638 University Ave.,
Los Gatos, Cal.

Print No. Ins. 136 on Reader Service Card

Portable A-C Dielectric Test Set For Motors, Wire, Transformers

A new line of portable a-c dielectric testers in compact bench-type cabinets provides up to 10,000 v at 1 kva, continuous rating. These instruments are said to provide economical a-c dielectric test facilities where high output current is required for breakdown testing of electrical equipment such as motors rated from two hp upwards, long sections of insulated wire, transformers, solenoids, and capacitance loads with high charging currents. Included in the line of "Hywatt Hypots" are eight models with outputs ranging from 1500 v a-c at 0.5 kva to 10,000 v a-c at 1.0 kva, continuous

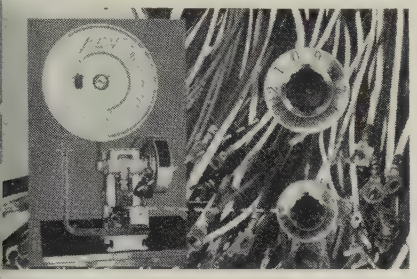


uty ratings. Intermittent ratings are pproximately twice the continuous atings. Operation is from 115 v, sinle phase 50-60 c a-c. Bulletin availble. Associated Research Inc., 3777 V. Belmont Ave., Chicago 18.

rint No. Ins. 137 on Reader Service Card

ligh-Speed Machine Attaches lany Terminal Styles and Sizes

A new high-speed attaching mahine is said to install a wide variety f terminal styles on any wire size, 22 hru 10, by simply turning two selector ials. The machine will install ring, pade, fork, hook, snap-on, or snap-in erminals, with or without insulation

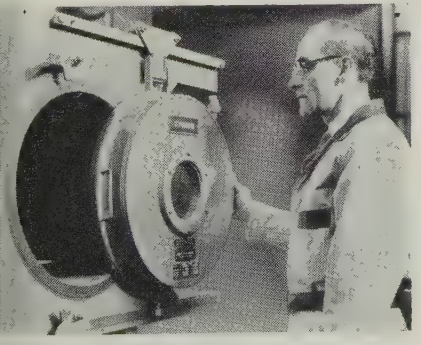


grips. A change in wire size is accomnodated by turning selector dials which automatically provide the necssary adjustments in staking pressure, without any machine set-up hanges on the part of the operator. A complete line of UL listed strip terninals in all sizes, shapes, and styles s also available. Brochure available. Kent Manufacturing Corp., 188 Needham St., Newton 64, Mass.

rint No. Ins. 138 on Reader Service Card

Vacuum Oven for Outgassing and Sealing Semiconductor Components

An improved version of a vacuum baking oven is designed for outgasing and sealing semiconductor compoents under high vacuum. The man-

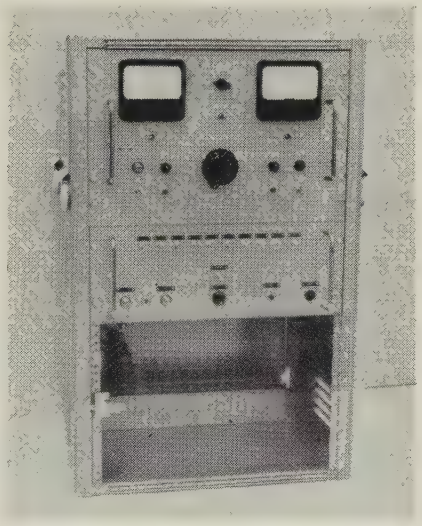


ufacture of these components calls for he fabrication and assembly of thin slices of crystallized silicon, germaium, and other highly reactive materials. Outgassing these materials requires a very high vacuum. Certain other operations, such as fusing or sealing the component into the subassembly, require moderate amounts of heat and must therefore be carried out in a nonoxidizing environment. The special oven is a self-contained "package" unit which produces this environment and reportedly provides an efficient method of carrying out these operations. F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20.

Print No. Ins. 139 on Reader Service Card

0-10 KV Semiautomatic Test Set with Test Cage

Features integral construction for nondestructive hipot testing of a group of components or multiconductor cable. Table top cabinet houses a 0-10 kv a-c/d-c sensitive hipot tester, a central panel for control of testing



sequence, and a heavy "Lucite" interlocked door leading to a large compartment for the group of components to be tested. Panel controls enable instantaneous high-voltage switching from a-c to d-c testing at up to 10 kv, push button control for selection of proper component out of a group or selection of order for testing sequence, and indicator lamps which remain lighted showing position within a group of faulty components or circuit, and reset circuitry—all to facilitate production testing. Peschel Electronics Inc., Towners, Patterson, N.Y.

Print No. Ins. 140 on Reader Service Card

New Millimicroammeter

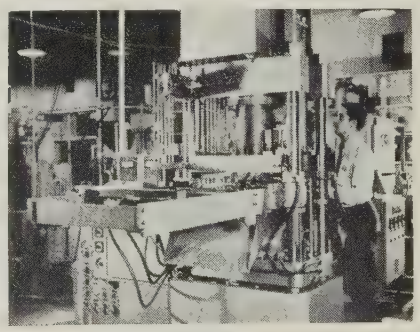
The model 1811 millimicroammeter is designed to measure low level d-c currents from less than 1 mμa to 3 ma. This instrument features a high gain feedback amplifier design with chopper stabilization which reportedly results in a full scale voltage drop of only 10 mv, and eliminates the need for a zero adjustment. The large 4½"

rectangular panel meter is protected from burn-out due to overloads, and the built-in current shunts can safely withstand overloads of 60,000 times full scale current at the lowest current range to 120 times full scale current at the highest current range. Accuracy claimed is 3% of full scale. Dynatran Electronics Corp., 178 Herricks Rd., Mineola, N. Y.

Print No. Ins. 141 on Reader Service Card

Automatic Transfer Molding Presses

A new series of Model 741 and 743 fully automatic transfer molding presses—in 50-ton, 75-ton, 150-ton, and 300-ton capacities—are designed to provide the maximum of flexibility and versatility in use. The controls are arranged so that the presses can



be operated either continuously, on a fully automatic basis, or intermittently, on a manual or semiautomatic basis. Features claimed include positive ejection, positive discharge, rapid press cycling, and minimum maintenance. Presses are equipped with preform pre-heaters and automatic feeders. Plastics Molding Equipment Div., F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20.

Print No. Ins. 142 on Reader Service Card

New Literature

All catalogs, bulletins, and other literature or sample cards described are available free of charge. To obtain your free copies, just print the item number on the Reader Service Card on the back cover. Fill out and mail the card—no postage is required. Insulation *immediately forwards your requests to the companies concerned so that literature can be sent to you promptly.*

Ceramic Insulation Reference Folder

A new reference folder for design engineers working with ceramics may be used either as a wall chart or as a desk-top reference. Form #42-874 contains three tables of conveniently organized information, including a temperature table for converting Centigrade to Fahrenheit or vice versa —from 0° to 3000°, a table of decimal equivalents of fractions in increments of 1/64″, and a table giving the mechanical and electrical properties of high alumina and steatite ceramics. Design considerations for ceramic products as well as suggestions for simplifying the specifying and ordering process are also listed. 4 pages. Centralab, the Electronics Division of Globe-Union Inc., 900 E. Keefe Ave., Milwaukee 1, Wis.

Print No. Ins. 201 on Reader Service Card

Laminated Insulation Sample Folder

Folder describes features and provides samples of eight flexible laminated electrical insulation materials including combinations of rag paper, polyester film, kraft paper, asbestos paper, glass fabric, Epoximat, and varnished fabric. 4 pages. Chase-Foster Inc., 34 Ormsbee Ave., Providence, R.I.

Print No. Ins. 202 on Reader Service Card

Publication on Vulcanized Fibre Selection and Application

A new periodical, called "Clues" (Volume 1, No. 1), describes and illustrates how the correct selection and application of vulcanized fibre can solve design and production problems. Some applications described are bobbins for electrical windings, insulating heads for armatures, and cap assemblies for universal lightin ducts, and distributor caps. 4 page Taylor Fibre Co., Norristown, Pa.

Print No. Ins. 203 on Reader Service Card

Catalog Sheet and Wire Sample on Polyurethane Magnet Wire Enamel

New catalog sheet CPP No. 8 list pertinent data on "Carthane" 806 polyurethane magnet wire enamel fo dip application. Specifications, typ ical properties obtained on magne wire, instructions on dilution for th dip operation, and outstanding prop erties are given. 2 pages. The Carwi Co., Polymer Products Div., North Haven, Conn.

Print No. Ins. 204 on Reader Service Card

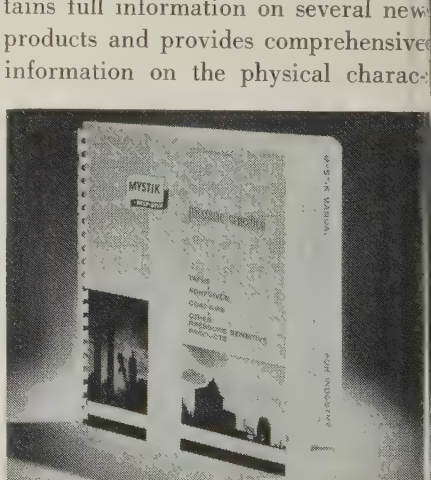
Brochure on Custom Molded, Rigid, Inorganic Insulation

New brochure describes a rigid in organic insulating material compose of special glass reinforced with mica Historical background of the material manufacturing techniques, and de sign considerations are outlined an some applications are illustrated. A table compares the properties of thi material with those of other molde insulating materials. 8 pages. Taunto Div., Haveg Industries, Inc., 336 Wei St., Taunton, Mass.

Print No. Ins. 205 on Reader Service Card

Cross-Indexed Manual on Tapes, Adhesives, and Coatings

A revised industrial manual con tains full information on several new products and provides comprehensive information on the physical charac



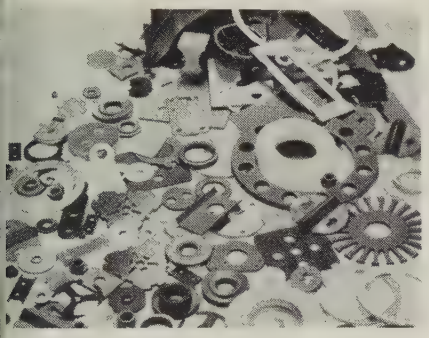
teristics and typical applications of company's complete line of industrial tapes, bulk adhesives, coatings, and other pressure-sensitive products. This

is said to be the only manual which cross-indexes products by Armed Forces specification data, by tape type, by tape function, and by industrial application. Mystik Adhesive Products Inc., 2635 N. Kildare Ave., Chicago 39.

Print No. Ins. 206 on Reader Service Card

Free Sample Kit and Literature Of Plastic and Fibre Materials

Free "Iten-Idea Kit" is said to be a practical aid in suggesting low-cost answers to material selection problems for products requiring the phys-



ical, chemical, and electrical characteristics of industrial plastics and fibre materials. The kit provides actual specimens of vulcanized fibre, laminated phenolic, and small molded nylon parts. Samples are selected in contrasting categories to provide a complete study of each material and its manufacturing potentialities. Graphic and descriptive data useful in product design and development and a printed supplement picturing and describing other "Iten-Items" for widely diversified applications are included. Iten Fibre Co., Iten Ave., Ashtabula, Ohio.

Print No. Ins. 207 on Reader Service Card

Bulletin Describes Benefits Of Custom-Built Elastomers

New bulletin No. 902 titled, "Achieving Better Designs with Custom-Built Elastomers," features illustrated examples of custom-built elastomers that helped turn designers' ideas into useful products. Information useful for designing new products that require specialized elastomeric properties is presented. Detailed two-page chart lists the general properties of the 10 major elastomers. It describes the origin and composition of natural rubber and nine synthetic elastomers, and lists their physical, chemical, and processing properties and environmental resistance characteristics. 6 pages. Lord Manufacturing Co., Erie, Pa.

Print No. Ins. 208 on Reader Service Card

Price and Data Sheets on Epoxy Coating for Circuit Boards

Applications of an epoxy coating on typical circuit boards are illustrated and described in a new data sheet. Characteristics of the material and directions for use are given. Price sheet lists prices for various quantities of resin and hardener. 2 pages. Empcor, 101 W. Verdugo Ave., Burbank, Cal.

Print No. Ins. 209 on Reader Service Card

Phenolic and Polyester Glass Molding Compounds Booklet

Electrical and other properties of 15 grades of phenolic and polyester glass molding compounds are outlined in a new technical data bulletin. Applications cited as typical include commutators, breaker handles, terminal insulating bases, communications equipment parts, and other electrical/electronic components.

Technical data bulletin 64-060 also lists applicable military specifications. 4 pages. Micarta Div., Westinghouse Electric Corp., Hampton, S.C.

Print No. Ins. 210 on Reader Service Card

Booklet on "Mylar" Polyester Film Properties and Applications

Booklet showing properties and suggested applications of Mylar polyester film contains charts that give physical, electrical, and thermal properties and show resistances to a wide range of chemical attack. A table lists available gauges, from ¼ to 10 mils, in four grades. The illustrated text shows 30 current applications of Mylar in electrical and other fields. 8 pages. Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich.

Print No. Ins. 211 on Reader Service Card

Brochure and List of Reduced Prices for ABS Plastics

New price schedule lists reductions of 7 to 9 cents per lb. in the price of "Cycolac" ABS plastics for molding, extruding, calendering, and vacuum forming. 6 pages. Brochure lists electrical, mechanical, thermal, and impact properties and describes and illustrates many typical applications. 8 pages. Marbon Chemical Div., Borg-Warner, Box 68, Washington, W.Va.

Print No. Ins. 212 on Reader Service Card

Large Polyolefin Moldings Booklet

A comprehensive analysis of large polyolefin moldings used for neutron moderation and shielding, for product prototypes, and for original equipment components covers three polyolefin types: branch-type polyethylene, linear-type polyethylene, and the newly developed polypropylene. Detailed specifications of company's complete line of large moldings in these materials (including block and rod), prices, selected references of typical applications, and illustrations are included. 4 pages. American Agile Corp., P.O. Box 168, Bedford, Ohio.

Print No. Ins. 213 on Reader Service Card

Technical Paper on "Teflon"-Ceramic Insulated Magnet Wire

Technical paper No. 60-1, "High Temperature Magnet Wire," by Stanley O. Dorst and Henry F. Puppolo, explains how the performance of polytetrafluoroethylene insulated magnet wire may be improved by the use of an underlying base of ceramic. The possibilities for use of the ceramic insulation at high temperatures are discussed. The paper was originally presented at the 1959 Conference on the Application of Electrical Insulation. 8 pages. Sprague Electric Co., North Adams, Mass.

Print No. Ins. 214 on Reader Service Card

Bulletin on Expulsion Protector Tubes To Protect Transmission-Line Insulation

Bulletin GEA-7033 gives detailed information on the operation, construction, application, and selection of new expulsion protector tubes for the protection of transmission-line insulation. Publication contains photographs, line and dimensional drawings, protection data, rating and dimensional tables, and accessory charts for standard expulsion protector tubes. 8 pages. General Electric Co., Schenectady 5, N.Y.

Print No. Ins. 215 on Reader Service Card

Mineral Insulated Cable Catalog

Revised catalog describing mineral insulated cable constructions contains two new sections: one discusses haz-

ardous area uses and the other covers use for instrumentation purposes. Historical background and other general information on the wiring system, cable properties, general application data, method of fabrication, suggested installation procedure, construction and performance characteristics, and ordering information are included. 20 pages. General Cable Corp., 730 Third Ave., New York 17, N.Y.

Print No. Ins. 216 on Reader Service Card

Testing Instrument Product Catalog

New bulletin 19-60-93 illustrates and describes complete line of "Megger" insulation testers, ohmmeters, earth resistance testers, dielectric test sets, cable fault locating equipment, transformer turn ratio test set, motor tester for measuring the electric resistance of a-c energized windings, motor rotation tester, corona test equipment, and other testing units and apparatus. 10 pages. James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.

Print No. Ins. 217 on Reader Service Card

Catalog of Cannon Plugs

Catalog of standard Cannon plugs may be used as a quick reference and/or ordering guide for buyers, purchasing agents, engineers, etc. Catalog outlines the applications, performance, sizes, etc. of all the principal Cannon plugs. 16 pages. Schweber Electronics, 60 Herricks Rd., Mineola, L.I., N.Y.

Print No. Ins. 218 on Reader Service Card

Catalog Sheet on Printed Circuit Board Holder

New catalog sheet illustrates and describes advantages of "Little Joe" No. 160 printed circuit board holder which can also be used for holding rectangular plugs. Time and cost-saving features and prices are listed. 1 page. Macdonald & Co., Dept. L-1, 1324 Ethel St., Glendale 7, Cal.

Print No. Ins. 219 on Reader Service Card

Booklet on Value Analysis Of Printed Circuits

New illustrated booklet, "Value Analysis of Printed Circuits," outlines the several functions that may be performed by the printed wiring board and describes the types of circuitry best adapted to this method of packaging as well as those where it shows up less favorably. If printed circuits are advantageous, various materials, constructions, and design details are discussed from a value engineering viewpoint. Suggestions are offered as to methods of reducing cost without affecting function or reliability. 16 pages. Arthur Ansley Manufacturing Co., New Hope, Pa.

Print No. Ins. 220 on Reader Service Card

Brochure on Catalyst Applications To Continuous Strip Ovens

New illustrated brochure describes applications of catalysts to continuous strip ovens. Featured is the use of long-life metallic supported catalysts in the conversion of noxious combustible waste gases to valuable heat energy. The economic savings and improved plant safety, as well as effective air pollution control are discussed. 4 pages. Catalytic Combustion Corp., Dept. 55, 4725 14th St., Detroit 8, Mich.

Print No. Ins. 221 on Reader Service Card

Engineering Data Sheets on Infrared Oven Heating Units

Two new engineering data sheets cover "RediRay" infrared heating units. No. 113 (1 page) lists specifications of an infrared oven for curing silicone extrusions. No. 111 (2 pages) discusses infrared heating modules for flexible, build-it-yourself ovens. The construction of the modules and typical oven configurations made from them are described and illustrated. Specifications, applications, and advantages are listed. Infra-Red Systems Inc., 240 Route 23, Riverdale, N.J.

Print No. Ins. 222 on Reader Service Card

Bulletin on Thermoplastics Extruders

New bulletin describes and illustrates several models of thermoplastics extruders from small 1" laboratory bench models to big 15" high-capacity extruders with automatic die head clamps. Packaged installations for rigid sheet and plastic pipe production, dies, and accessories are also covered. 4 pages. National Rubber Machinery Co., 47 W. Exchange St., Akron 8, Ohio.

Print No. Ins. 223 on Reader Service Card

Dates to Circle

Meeting and Convention Notices

May 1-5 . . . National Assn. of Electrical Distributors, 52nd Annual Convention, Memorial Auditorium, Dallas.

May 1-5 . . . Electrochemical Society, Technical Meeting, La Salle Hotel, Chicago.

May 2-4 . . . AIEE, North Eastern District meeting, Sheraton Biltmore Hotel, Providence, R.I.

May 2-4 . . . IRE, National Aeronautical Electronics Conference, Biltmore and Miami-Pick Hotels, Dayton, Ohio.

May 3-5 . . . Western Joint Computer Conference, sponsored by AIEE, IRE, and ACM, Jack Tar Hotel, San Francisco, Cal.

May 4-5 . . . The Wire Assn., Electric Wire & Cable Section Regional Meeting, Sheraton Hotel, Philadelphia.

May 8-11 . . . NISA, Annual Convention, Hotel Fontainebleau, Miami Beach, Fla.

May 10-12 . . . Electronic Components Conference, sponsored by AIEE, IRE, EIA, and WEMA, Hotel Washington, Washington, D.C.

May 12-13 . . . SPI, National Plastics Molder & Suppliers Conference, American Hotel, Bal Harbour, Fla.

May 16-17 . . . Domestic Appliance Technical Conference, 11th Annual Meeting, Mansfield, Ohio.

May 18-20 . . . EIA, 36th Annual Convention, Pick-Congress Hotel, Chicago.

May 19-29 . . . International Plastic Exhibition, Oslo, Norway.

May 23-25 . . . National Telemetering Conference, sponsored by AIEE, ISA, Institute of the Aeronautical Sciences, and The American Rocket Society, Hotel Miramar, Santa Monica, Calif.

May 23-26 . . . Design Engineering Show, Coliseum, New York City.

May 24-26 . . . IRE, Armed Services Communication and Electronics Association Convention and Exhibit, Sheraton-Park Hotel, Washington, D.C.

May 24-26 . . . IRE, 7th Regional Technical Conference and Trade Show, Olympic Hotel, Seattle, Wash.

June 1-3 . . . IRE, 6th Radar Symposium, Ann Arbor, Mich.

June 6-8 . . . Institute of Appliance Manufacturers, 28th Annual Convention and Exhibit, Netherland Hilton Hotel, Cincinnati, Ohio.

June 9-10 . . . The Wire Assn., Pacific Coast Regional Meeting, Statler Hilton Hotel, Los Angeles, Calif.

June 10-26 . . . British Exhibition of Industry, Technology, Science, and Culture, sponsored by the Federation of British Industries, Coliseum, New York City.

June 13-15 . . . American Society of Heating, Refrigerating, and Air-Conditioning Engineers Inc., 67th Annual Meeting, Vancouver Hotel, Vancouver, B.C., Canada.

June 14-17 . . . National Association of Purchasing Agents, The Waldorf-Astoria, New York City.

June 18-26 . . . Europlastica Exhibition and Trade Fair, Floralies Palace, Ghent, Flanders. For information contact Europlastica Secretairate, Palais des Floralies, Ghent, Flanders; or Office Belge des Matieres Plastiques, Galerie du Centre, Bloc 3, Rue des Fripiers, Brussels.

June 19-24 . . . AIEE, Summer General Meeting, Chalfonte-Haddon Hall, Atlantic City, N.J.

June 22-24 . . . Conf. on Electronic Standards and Measurements, NBS Boulder Labs, Boulder, Colo.

June 25-July 9 . . . IRE, Congress of International Federation of Automatic Control, Moscow, USSR.

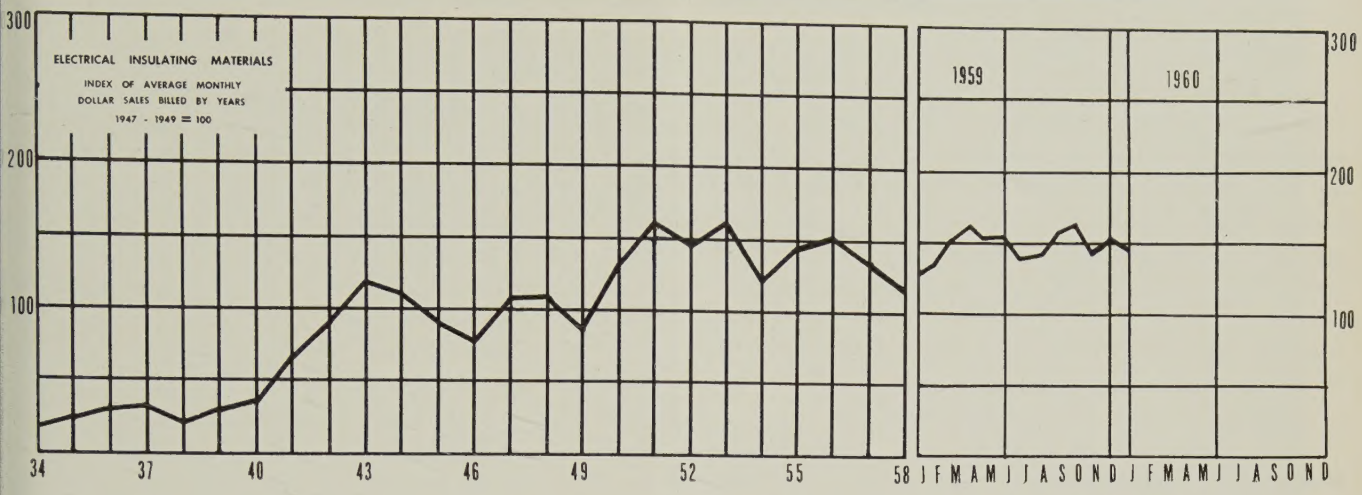
June 26-July 1 . . . ASTM, 63rd Annual Meeting & Exhibit, Chalfonte-Haddon Hall, Atlantic City, N.J.

June 27-29 . . . IRE, National Convention on Military Electronics, Sheraton Park Hotel, Washington, D.C.

Abbreviations Used in Notices

AIEE	—American Institute of Electrical Engineers	NEMA	—National Electrical Manufacturers Assn.
ASTM	—American Society for Testing Materials	NISA	—National Industrial Service Assn.
ASME	—American Society of Mechanical Engineers	SPE	—Society of Plastics Engineers
ASA	—American Standards Assn.	SPI	—Society of the Plastics Industry
IRE	—Institute of Radio Engineers	WEMA	—Western Electronic Manufacturers Assn.
EIA	—Electronic Industries Assn.		

NEMA Electrical Insulation Index



	Jan. '60	Dec. '59	Jan. '59
Index series	146	154	130
Jan. '60 point change from other mos.		−8	+16
Jan. '60 % change from other months		−5	+12

Index is based on 1947-1949 average month, inclusive= 100

Published through the courtesy of the National Electrical Manufacturers Association

Materials Used in Electrical Insulation Index

Industrial Laminated Products
Manufactured Electrical Mica
Varnished Fabric and Paper
Vulcanized Fibre
Varnished Tubing and Saturated Sleeving (From May, 1952)

Advertisers' Index

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	Belden Manufacturing Co.	65
Ins. 1	Bentley-Harris Manufacturing Co.	Inside Front Cover
Ins. 61	Billings Machine & Tool Co.	84
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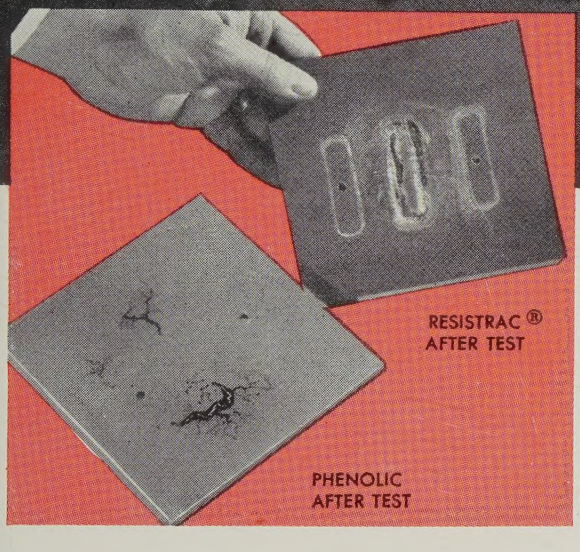
413 Lafayette Bldg. Phone WOodward 1-0278

New York 17, N.Y.—Robert Bandini
41 E. 42nd St. Phone MUrray Hill 2-3157

San Marino, Calif.—H. L. Mitchell & Assoc.
1450 Lorain Road. Phone CUmberland 3-4394

Oakland 18, Calif.—James T. Stevenson
5901 Buena Vista Ave. Phone OLympic 3-8602

1000 Times Greater Track Resistance in Your Insulating Components



ABOVE: 10-sec. time exposure shows insulating material subjected to ASTM suggested dust & fog test. 1500 volts applied between electrodes causes arcing on the moist, contaminated surface.

LEFT: Samples of molding materials after test. Phenolic tracked to ground in 27 min. RESISTRAC is eroded after 648 hrs. but exhibits no carbon tracking.

New GLASTIC RESISTRAC

This fiber glass reinforced alumina-polyester combines resistance to carbon treeing and dimensional stability approaching that of ceramics, and the toughness and precision of plastics. RESISTRAC offers the designer a material free from the tracking limitations of thermosetting plastics and without the shortcomings of ceramics.

Consider this excellent *combination* of properties:

Outstanding Track Resistance—50 times the tracking resistance of conventional fiber glass polyester premix. 1000 times the tracking resistance of phenolics.

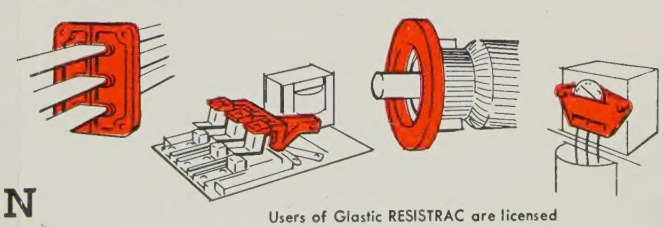
Flashover Resistance—Unlike ceramics, it gives shatter proof performance under the thermal shock of power flashover.

Chipping Resistance—From 3 to 6 foot pounds Izod impact strength compared with .05 to 1.0 foot pounds for most ceramics.

Flame Resistance—Completely self extinguishing. 90 sec. ign., 30 sec. ext. (Fed. Spec. LP 406b).

These design advantages plus heat resistance, low moisture absorption, and excellent moldability can offer real product improvement in apparatus where carbon tracking is a danger. And full design utilization of the properties can result in significant cost savings.

RESISTRAC is available in molded parts and in sheet stock. Write for engineering data.



HE GLASTIC® CORPORATION
21 Glenridge Road Cleveland 21, Ohio

Users of Glastic RESISTRAC are licensed for its application as covered in U.S. Patent 2,768,264.

Print Ins. 64 on Reader Service Card

Rea winds 50,000 coils a year ... then throws them all away!

Why? Because Rea Magnet Wire engineers have discovered the real secret of quality-testing magnet wire. Use it!

Wind coils. Test them. Discard them. Wind more coils. Keep testing. Use wire just as severely as our most demanding customer uses it.

We also use a wide variety of other tests to assure our customers of wire with *proven* quality. They're necessary, too. But we'll keep on winding coils and using them . . . just like you do. That way you'll always be sure of the quality of Rea Magnet Wire . . . just like you are now.

REA®

REA MAGNET WIRE COMPANY

FORT WAYNE, INDIANA

Copper and Aluminum Magnet Wire, All Insul

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